NATURE MAGAZINE

JANUARY 1924

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NATURE CALENDAR

JANUARY

> "Take Winter as you find him, and he turns out to be a thoroughly honest fellow, with no nonsense about him, and tolerating none in you, which is a great comfort in the long run."—*J. R. Lowell, "When Winter Comes."*

In the words of Burroughs, "The snow is a great telltale and blabs as effectually as it obliterates. I go into the woods and know all that has happened. I cross the field, and if only a mouse has visited his neighbor, the fact is chronicled."

Winter is rich in beautiful sights and enchanting stories of animal and plant life. Seek them and that restless longing for spring will vanish like magic.

The very window-pane is etched in exquisite designs of unbelievable intricacy.

Without, lays the silent snow, a smooth blanket over all the earth.

The wine-red drupes of the staghorn sumac are beautiful against the background of snow.

They offer more than just esthetic attraction, for winter birds find them a most delectable feast.

Here too, are, in truth, crowded insect-tenements where many little six-footed creatures have taken winter quarters.

What a vision of strength is the oak in winter with its massive trunk and powerful limbs, bent and gnarled with fighting the forces of Nature!

As we gaze at the vast stretches of white, we are reminded of the words of Whittier,

> Beneath the winter's snow
> Lie germs of living flowers.

When Mr. Fox takes his "forty winks" he wraps his luxurious tail around his nose and toes to protect them from the cold.

It is often true that "by their favorite diets you may know them." Seed-bearing weeds and plants attract juncos and sparrows. Where bayberries are abundant you may find some myrtle warblers. Cedar-berries often tempt the waxwings, robins and bluebirds to winter near them.

Orion, the great hunter, is conspicuous in the southern half of the heavens.

And ever that small misty group of stars, the Pleiades, enchants us, arousing that inexpressible feeling of infinity.

There is but little movement of birds this month. Put out some food each day and you will form a real friendship among them.

Winter fashions for starlings favor coat and vest heavily spotted in buff and white.

In winter, the fur of the deer is specially adapted for swimming. The hairs are composed of air cells and when the coat is about an inch long it will suffice to float him.

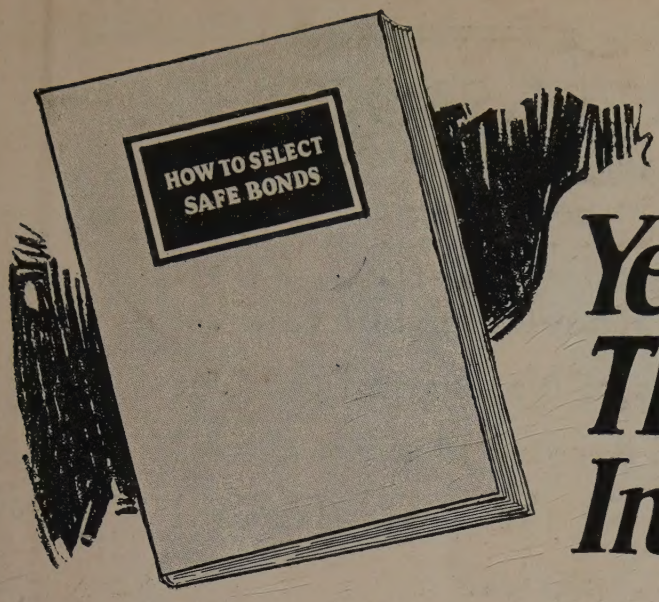
Most of the bucks shed their antlers in January.

The caribou literally grows showshoes for the winter. The edges of the hoofs grow out in thin sharp ridges which make him able to travel easily through the snow and on icy surfaces.

In northern parts the weasel has changed to a costume of white to match the snow. We know him thus as the ermine.

Porcupines are feeding on the bark and twigs of the hemlock.

Prepared for Nature Magazine by the Cleveland Museum of Natural History



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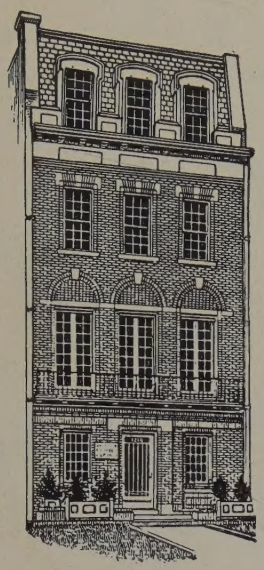

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Nature Magazine

An Illustrated Monthly With Popular Articles About Nature

Percival Sheldon Ridsdale, *Managing Editor*

Arthur Newton Pack, *Associate Editor*

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JANUARY, 1924

VOL. 3
No. 1

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Nature Magazine is published monthly by the American Nature Association.
Publication Office, 1918-1932 Harford Avenue, Baltimore, Md. Editorial and Executive Office, 1214 16th Street, Washington, D. C.

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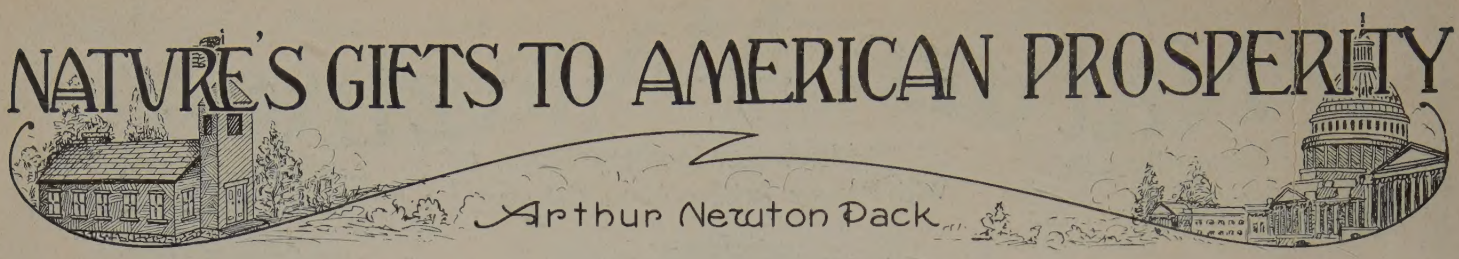
Entered as second class matter February 1, 1923, at the Postoffice at Baltimore, Maryland, under the Act of March 3, 1879.

NATURE'S GIFTS TO AMERICAN PROSPERITY



Arthur Newton Pack

We can find our way about in the dark in our own home. We cannot in a friend's home until we have become accustomed to the way his furniture is placed, his rooms arranged. The great majority of Americans do not know exactly how the furniture is placed in their own economic home. They walk in the dark and stumble.

WHY is the United States a great nation? How is it that we have been blessed among nations with an ever-growing prosperity? Why does Europe look to us today as her greatest hope of salvation from business and economic troubles?

There is only one answer. Modern civilization depends upon the development and control of a few fundamental raw materials. These are the bases of the food, the fuel, the clothing and the luxuries of the world. We know them as natural resources. In their initial state they are potential wealth. Harvested, mined and manufactured, they are the great commodities of commerce.

We like to believe that our national prosperity is man-made. We like to credit it to our intelligence, industry and thrift. To an extent we may do this. Without these qualities we might be in the position of Russia today—possessors of great natural resources but poor beyond measure. The raw materials may exist, but the will and ability to develop them must be there as well.

America is abundantly rich in soil and climate for the production of forests and every staple food. It is rich in animals and bird life, which contribute directly and indirectly to our daily comforts. It is rich in coal, metals and water power necessary to the manufacture and refinement of all raw materials.

We are prone to take our assets as a matter of course. Rarely do we compare our fortunate position with those of other peoples. Indulged in the richness of natural gifts, we are frequently wasteful. We have despoiled our forests and must turn to growing them again. We have been prodigal of our coal and oil and must turn to the task of getting from them the full measure of wealth that they represent.

In the rapid, even spectacular process of building prosperity with the materials a wise nature has given us, we have created a complicated machine. Frequently the machine falters or breaks down. Problems affecting every man, woman and child are presented. Prices climb and fluctuate, apparently without reason. From platforms politicians advance schemes to cure passing or persisting economic ills. From their studies economists present us with plans designed to solve our problems. Often their proposals become law or custom. They change the existing order, perhaps for better, perhaps for worse. Then there are new problems, perhaps more difficult ones than those we had before.

There must be some way of getting at these questions in a simple and logical way. What we need is understanding. When we wish to solve a mathematical problem we start with a few essential figures and formulae. When we learn a language we lay a basis of knowledge of grammar and build on it with vocabulary. In many things of life we start at the root of things. Why can we not do so with our economic problems?

The starting point of our system of production, marketing and consumption is natural resource. The system is complicated, increasingly so. Surely we can, with profit, go back to the beginning. We can lay a groundwork of knowledge, of understanding. This can begin in school days and be carried through into life, preparing every boy and every girl to be an intelligent judge and sane voter, and every man and every woman to be qualified to change that judgment and vote as needs arise and sound knowledge dictates.

In chemistry we are taught that everything is composed of certain fixed elements. We do not need to reduce our national wealth of natural resources to chemical terms. We should know the fundamental structure of many of them, the better to realize their irreplaceable nature in many cases. Such knowledge will heighten the respect of a people for the gifts of nature. But we do need to know the simple facts of the use of these natural resources; their importance to our individual and collective life; their position in the economic scale. We should understand the fundamentals of their manufacture; their value as by-products; their possibilities as solutions of our problems.

To condense the first principles of the vast amount of information into a series of brief articles is perhaps a difficult task. It is hoped, however, that this can be accomplished in the series which will follow. It is hoped that they will encourage boys and girls and men and women to the further study of many of our common problems in the light of nature and economics.

NATURE MAGAZINE

Vol. III JANUARY, 1924 No. 1

Burning Former Plant Life

Coal of the present day was the vegetation of an earlier age

By JOHN HAYS HAMMOND

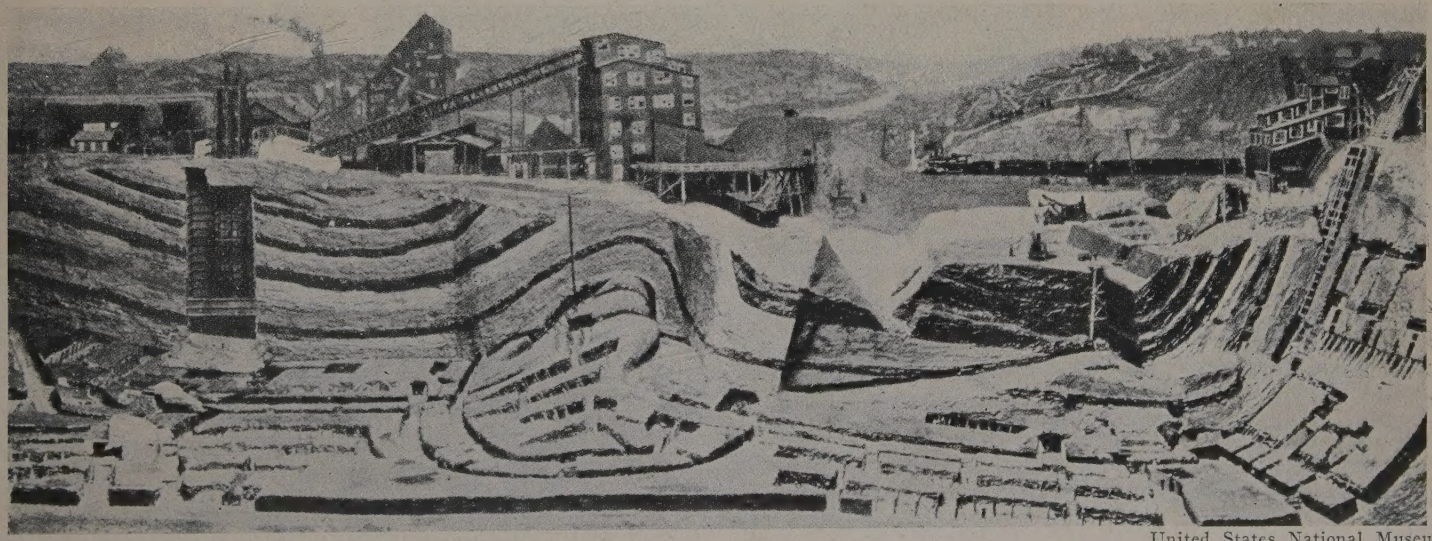
Chairman of the United States Coal Commission

IF your name was Li Hung Tong and you lived amidst the luxuriant grasslands of interior China, you would be interested in neither coal questions nor fuel problems. In winter you would merely add one, two or many layers of clothing to your daily wardrobe. If, perchance, you were a member of the wealthy class, you might burn curious fagots of hay in one of the strangest stoves in all creation.

Not following the Chinese custom of doubling and trebling the clothes we wear as the mercury drops, we Americans have turned to natural fuels, taken from the earth in various ways. In Colonial days, when our timberlands were numerous, even almost impenetrable, we burned lavishly of our wealth of wood. In time, peat bogs were discovered and the settlers burned these dried cakes of swamp turf. Then came coal when miner immigrants uncovered seams of black diamonds in the adopted Motherland.

The strange story of coal is an epic in the history of nature and industry. It is the measure of civilization and economic progress. Coal has changed the social structure of the world. It has harnessed power to the behest of mankind. It has stimulated his invention, caused wars, and dictated terms of peace. Hard black nuggets, blasted and torn from the earth, have brought men closer together. They have given to mankind comforts, opportunity and power.

We are told by science that 150,000,000 years ago—perhaps more, perhaps less—the whirling sun loosed the earth into its orbit. Thrown off into the universe, the new planet began to cool.



United States National Museum

SHOWING HOW THE VEINS OF ANTHRACITE COAL LIE BELOW THE SURFACE

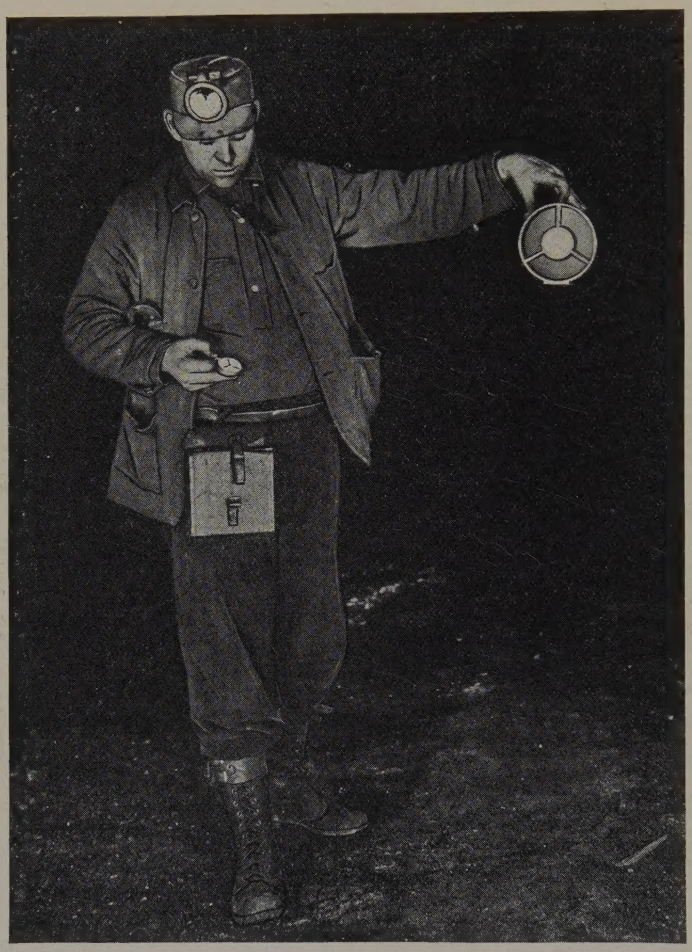
Above the surface are to be seen the shaft heads, the breakers, culm piles, and the railroad for transportation of the coal. Part of the coal must be left in the veins to support the roof of the workings.

Great ridges appeared along the line of what is now the Atlantic seaboard of America. Valleys lay where the Appalachian Mountains are today. In intervening lowlands, as the ages passed, lush forests grew, shedding their thick leaves and spores. There was a shifting of inland seas, burying plant life under ooze and silt. The seas receded and another verdant growth covered the lowlands, to be itself buried.

Over much of the coal country the beds of coal have been left much as they were first deposited, but in some places, notably in the anthracite region of eastern Pennsylvania, they were folded and crumpled by the earth-processes that accompanied the formation of the Appalachian Mountains.

Under the pressure of the overlying rocks, the moisture and gaseous matter in the original vegetation have been largely driven off and in the anthracite beds this process has gone so far that practically nothing but pure carbon is left.

Coal, therefore, is the product of trees, ferns, mosses and other plant and tree life of a verdant age, compacted by the tremendous pressure of overlying rocks and packed away in the vaults of the earth. It is a product of the soil, preceding mankind by many ages, but left by a wise Nature until that day when man might discover it and turn it to his command.



AIR FOR UNDERGROUND

On the surface near the mine shaft is a huge fan which forces fresh air down into the mines. This shows an inspector testing the flow of air in the mine with an instrument devised for that purpose.

For many centuries, as isolated civilizations grew and fell, coal played no part. Its only use was as a domestic fuel, and then in cases where it cropped out on the surface of the ground or was washed ashore. Its existence in great quantities was known, but it was not until the decade of 1750 to 1760 that progress called upon coal to play its part. It was then that the industrial age began. The steam engine, a crude affair, had been invented, but still was an instrument to be regarded with wonder, if not suspicion. Machinery for spinning and weaving had been going through a gradual period of perfection until the point was reached when other than man power was needed.

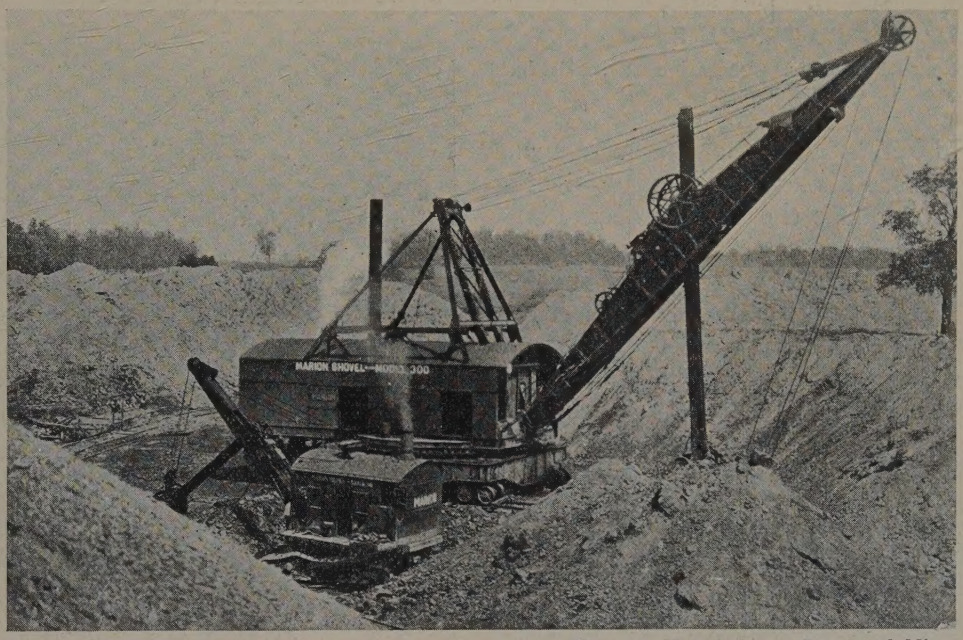
Thus it was that coal entered the great drama of civilized progress, playing the part, first, of the producer of steam power. It gradually assumed more parts, devoting its strength to smelting of iron and steel, driving engines and steamboats and producing the motive power for coal-driven engines of myriad varieties. Since coal came into its dominance, the world has flourished in wealth and population. It opened a multitude of new ways in which man could surround himself with comforts and refinements, travel about among his fellowmen with greater ease and live more fully. It also created for him problems of social and economic nature, which he is today attempting to solve.

The history of coal in the United States is linked with the growth of the industrial age in Europe. The New World was first colonized as a granary, supplying the essential foodstuffs, while England harnessed coal in building up her industrial superiority. It was simple to live off the soil in America. The new country was rich and prosperous by her agriculture. Then the industrial revolution brought manufacture to the newer land, adding wealth abundant to the resources of America.

In any consideration of coal in the United States, either in its absorbing historical aspects, its economic significance or its present condition of supply, it is necessary to distinguish between anthracite and bituminous coal. The former, commonly known as hard coal, was subjected to a more tremendous heat in the age of its making. Soft, or bituminous, coal was made by comparatively little pressure other than by rocky strata. They differ in substance in that the hard coal contains little volatile matter, such as oil, gas and tar, while soft coal is richer in these properties in varying degrees.

Underneath more than 460,000 square miles of the surface of the United States are deposits of coal. They vary in thickness of layer, and they include lignite, bituminous, semi-bituminous, anthracite and semi-anthracite. It is estimated that this resource comprises four thousand billion tons, and the United States supplies two-fifths of the coal now being taken from nature's storehouses throughout the world.

The hard coal deposits of the country are concentrated in less than 500 square miles of eastern Pennsylvania. Our bituminous supply is found in the Appalachian region from Pennsylvania to Alabama, in Illinois, Indiana and western Kentucky and in a zone from Iowa, Arkansas and Oklahoma. It is mined commercially, in fact, in thirty-one states, but the bulk of the supply comes from the Appalachian territory. The Rocky Mountain fields supply the major needs of the Pacific coast states and in the southwest oil is becoming the dominating fuel for many purposes. Going westward from the anthracite fields in northeastern Pennsylvania, the coal-bearing strata become flatter and have not been subjected to the compression which produced changes converting the low-grade coals into the higher-grade coals of the anthracite class.



Courtesy United States Bureau of Mines

OPEN PIT, SHOWING STEAM SHOVEL LOADING COAL

This kind of operation is frequent in the soft coal region where the coal is near the surface, and is sometimes used in the anthracite region.

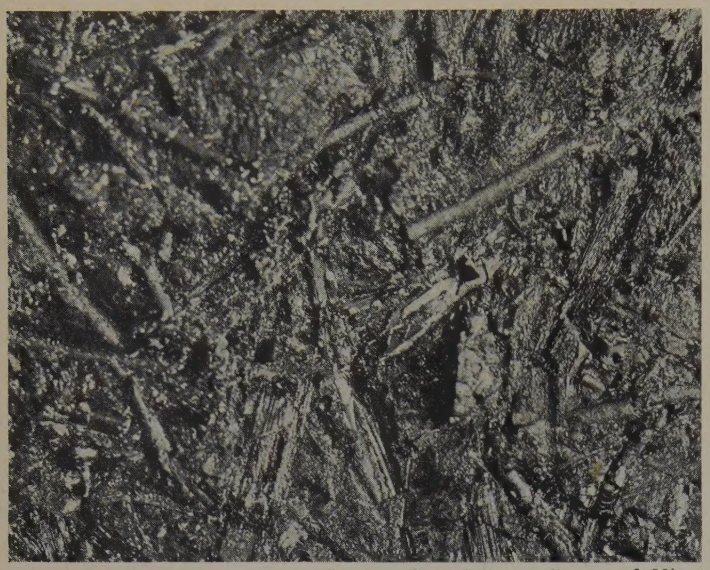
Historically, also, there is a distinction between hard and soft coal as used in the United States. Bituminous was mined to do the work of industry and there was little to learn about its use. With anthracite, however, it was a different story. When the shiny, hard chunks were taken out of the earth in eastern Pennsylvania, it was attempted to set them at work like bituminous. They looked like coal, but they refused to burn like the orthodox bituminous product.

There are several stories of the first attempts to make anthracite coal behave as it was then thought all coal should behave. It came to be known as "stone coal," and for a number of years was commercially unpopular. It is related, as one of the stories of the discovery of the secret of hard coal, that the owner of Fell's Tavern, in Wilkes-Barre, Luzerne County, Pennsylvania, had some anthracite nuggets lying about. He threw some of them on a wood fire burning in an open grate one night and retired. Imagine his surprise the next morning, after he had been repeatedly told by guests at his tavern that the stuff was no good, to find an extraordinarily heat-giving fire burning in the grate.

Another version has it that a blacksmith near Scranton had a pile of the "stone coal" in his yard. He was a stubborn chap and told himself one day that he would make the stuff burn. He put it in his forge, poked it, blew air through it and otherwise treated it like any well-behaved soft coal. He stuck to it without success and finally went home in deep disgust. The next morning he found it burning merrily in his forge, a decidedly satisfactory fire.

The circulation of stories against anthracite coal retarded its use for a time. This prejudice was gradually overcome and today about 80,000,000 tons of this anthracite fuel are taken from the mines every year, and a goodly part of it slips down the coal shutes into the bins of householders. Its consumption is chiefly domestic, and is in considerable measure limited to the northeastern states, which have never welcomed bituminous coal with any degree of cordiality.

When one says that the coal resources of the United States total some four thousand billion tons, or that those of the world are in excess of seven thousand billions, it seems an immense amount. This supply is not unlimited, however. It cannot be replaced. All the coal that there is ever going to be was packed away millions of years ago. Also much of the coal included in the world's resources is unfit for the production of power; is so deep in the earth as to be unprofitable to mine, or is located at such remote corners as to be impracticable com-



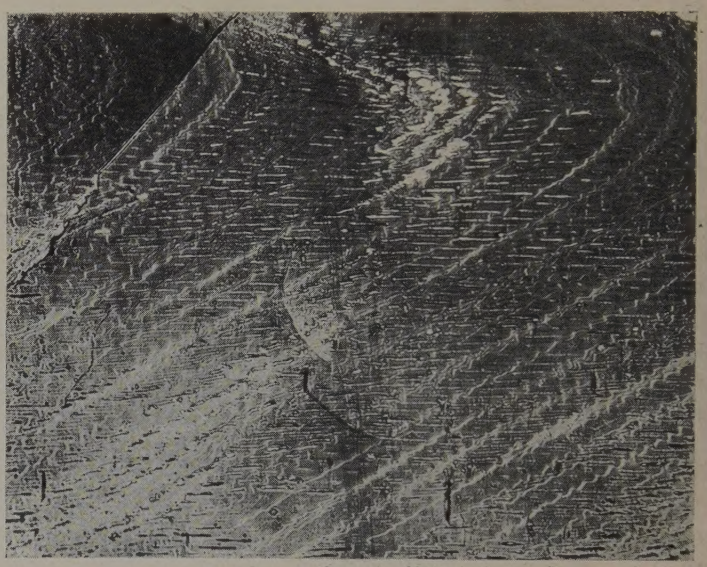
Courtesy United States Bureau of Mines

COAL MAGNIFIED TEN TIMES

This shows the woody structure of a piece of soft coal which has been cut horizontally.

mercially. In the United States, when the moment came to harness coal, it was exploited with the same prodigality that marks the history of the cutting of our vast timber resources of early days. There was, and still is, much waste in the mining of coal in our country. It is estimated that a ton of coal has been left to waste underground for every ton brought to the surface for industry or home. And it must be realized that an awakened public opinion will stop mining timber and make it a crop, while coal must always be mined. Waste, however, permits of reduction.

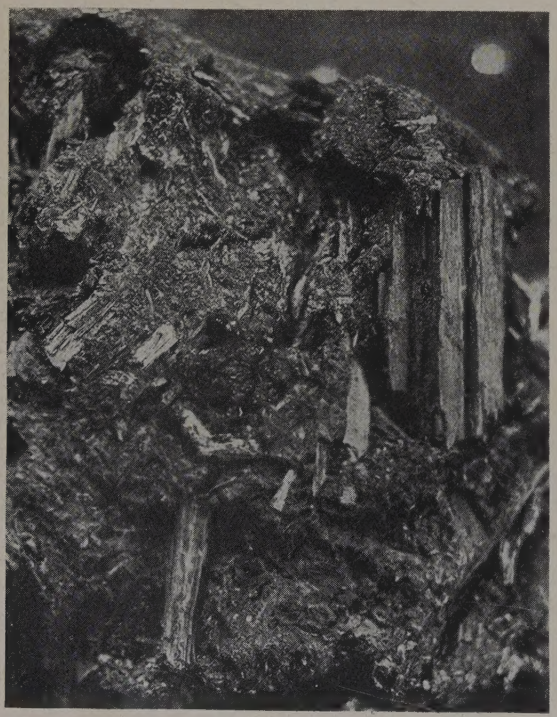
The bituminous resources of the country will last for centuries, but the bulk of anthracite deposits will, at the present rate of consumption, approach depletion within a century. Many of the important producing anthracite mines have a life of not more than another generation, after which the anthracite supply must be obtained from coal beds at much greater depth than those at present mined. But few anthracite mines are today more than 1000 or 1500 feet in depth, while in Europe deeper beds of coal are being worked to a depth of 3000 to 4000 feet. So looking ahead to the next generation the mining of anthracite under present economic standards will be very greatly increased, not only because of the increased depth and the larger volumes of water which must be hoisted, but because of the fact that those deep-lying beds of coal are very much more broken up than the beds situated nearer the outcrops.



Courtesy United States Bureau of Mines

COAL MAGNIFIED 200 TIMES

A cross section of a piece of soft coal in which the woody tissues are clearly diseernible.



Courtesy United States Bureau of Mines

LUMP OF PEAT (NATURAL SIZE)

This shows vegetable matter which burns and which is an undeveloped form of coal.

It is evident, therefore, that there must be changes in the great and fundamentally important industry of mining coal. To this end the United States Government created a commission to find out the facts of the coal industry, to consider possibilities of reorganizing and revamping it and to recommend legislation. The extent of this problem is illustrated by several complicated conditions existing in the industry. The commission has regarded the anthracite industry as in the nature of a monopoly, whereas in the bituminous fields there is extreme competition.

At present there are more than 9000 mines in

the United States, from which coal is being taken. About 850,000 coal miners are employed, of whom 150,000 are in the anthracite district of northeastern Pennsylvania. One hundred and eighty railroads move the coal from the mouths of these mines, carrying the fuel long distances in many cases and taxing the transportation system with a heavy bulk freight. The exploitation of the bituminous fields in particular has been without plan. There is a vast amount of cross-shipment, some of it necessary because of special demands of industry, but much of it waste. Planless competitive conditions exist, making the processes of mining themselves wasteful as well as the process of distribution.

What all these conditions mean to the consumer is summed up in this statement of the United States Coal Commission, which says:

"An analysis of the consumer's dollar, based on an examination of the books of retail dealers in

Courtesy United States Bureau of Mines

UNDER-CUTTING A COAL VEIN

After this is done the vein or bed is blown down by explosives and the coal loaded into cars.

several of the larger cities, may serve to show the component parts of the price he paid. For example, in November, 1922, in Boston, the average retail price of stove coal at the customer's curb was $15.68 a net ton. At this rate, a dollar paid for 128 pounds of coal. Of this dollar, 45 cents represented the sales price at the mine, 23 cents the charge for freight, and 32 cents the share of the dealer. In New York the average price was $13.77. Here the dollar paid for 145 pounds of coal, and 56 cents, 18 cents and 26 cents represented the division between mine, railroads and dealers. In Philadelphia the price, figured on a net-ton basis, was $12.93, so that the dollar paid for 155 pounds of coal, with 61 cents, 16 cents and 23 cents as the respective shares of mine, railroads and dealers. In Washington the price, figured on a net-ton basis, was $14.20, and the consumer's dollar paid for 141 pounds and included

Courtesy United States Bureau of Mines

THE "FACE" OF A CHAMBER

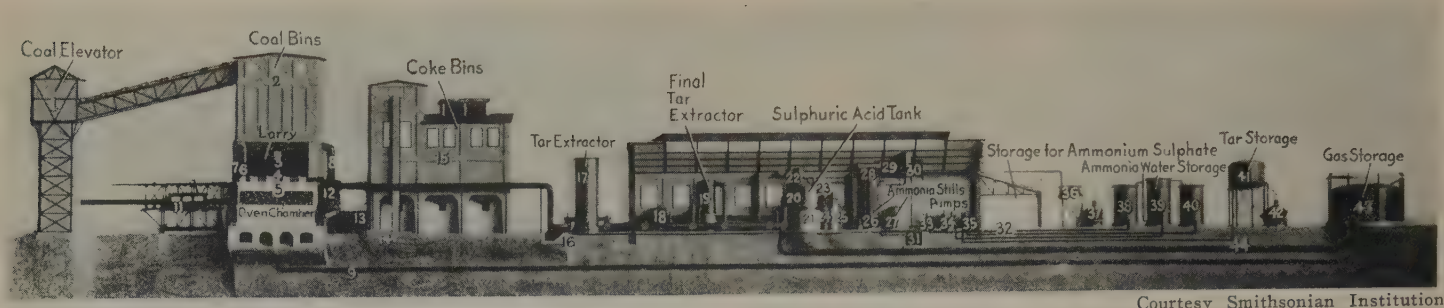
How the miners cut the coal and support the roof in opening up the seams of coal.

58 cents as mine price, 20 cents as freight and 22 cents to the dealer. In Chicago, at the greater distance from the mines, the consumer's dollar paid for only 120 pounds of coal, and included 49 cents as the mine price, 30 cents as freight, and 21 cents as the dealers' costs and profits. In St. Louis, with a price per ton 44 cents lower than in Chicago, the dollar contained only 15 cents for the dealer. This abstract of a much larger exhibit is sufficient to show that from 15 to 32 cents of every dollar spent for Pennsylvania anthracite remains with the local dealer or possibly in part with a wholesaler from whom he obtained the coal, and between 45 cents and 60 cents goes to the producer."

Courtesy United States Bureau of Mines

ROOF SUPPORTED BY TIMBER

These pillars of wood replace the coal, otherwise the roof of rock would weaken and fall



Courtesy Smithsonian Institution

TAKING THE BY-PRODUCTS FROM COAL

Locked up in nature's store, a lump of coal, are many of our useful acids, chemicals and other products, and science will undoubtedly discover more of this natural wealth.

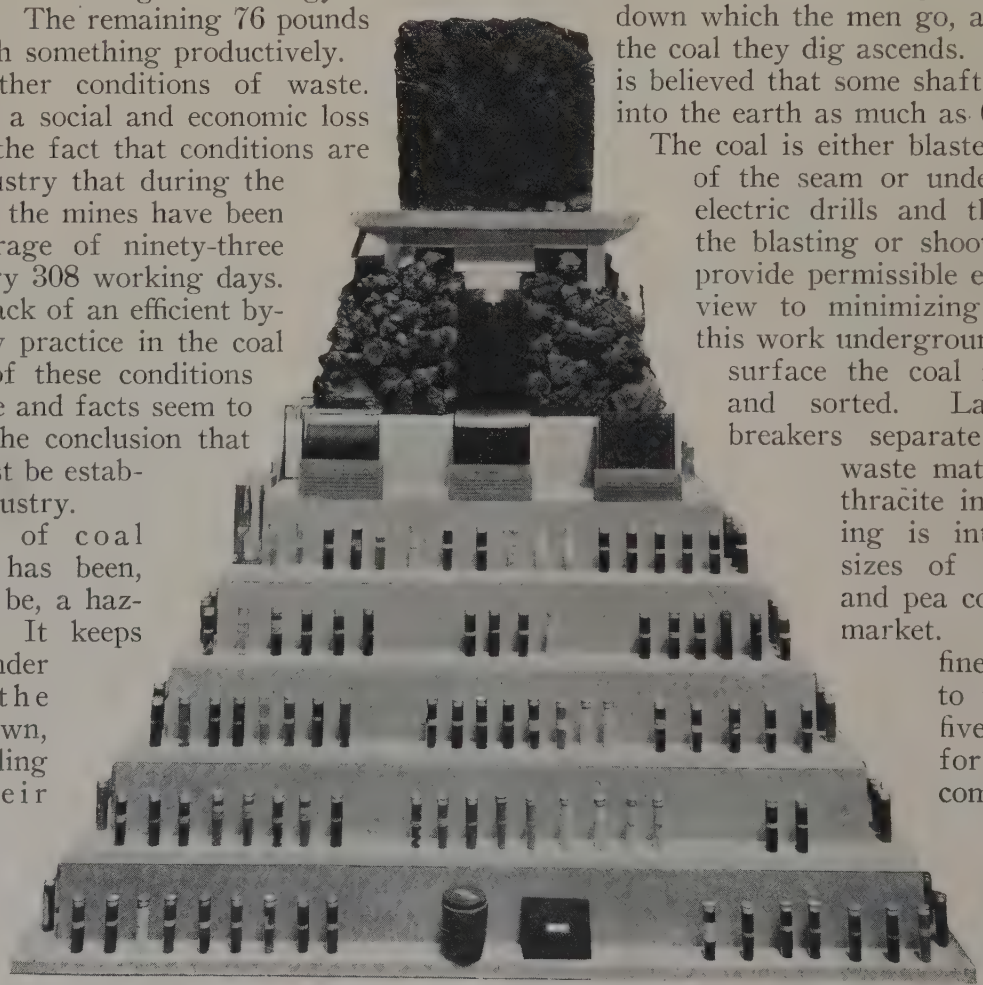
The director of the United States Geological Survey has divided up the dissipation of every 2000 pounds of coal into component parts. He figures that at the outset 600 pounds are lost in mining. Once the remaining 1400 pounds are brought to the surface, it takes 126 pounds to get the coal from the mine to the boiler room. Arrived there, he estimates that 446 pounds float up the smoke-stack in waste gases, 51 pounds escape in radiation and another 51 into the ash pit, and 650 pounds are lost converting heat energy into mechanical energy. The remaining 76 pounds really accomplish something productively.

There are other conditions of waste. One of these is a social and economic loss resulting from the fact that conditions are such in the industry that during the last thirty years the mines have been idle on an average of ninety-three days out of every 308 working days. Another is the lack of an efficient by-product recovery practice in the coal industry. All of these conditions permit of change and facts seem to point today to the conclusion that a new order must be established in the industry.

The business of coal mining always has been, and always will be, a hazardous calling. It keeps 700,000 men under the face of the earth, deep down, digging, drilling and blasting their way into seams of coal. Its dangers have been checked in some measure, however, by the passage of regulatory laws and by the installation of safer methods. Nevertheless, the human element still exists and there are conditions of carelessness on the parts of both manager and man.

In form the coal mine has been described as having the appearance of a crushed centipede. If the surface could be lifted off, as one cuts open an ant-hill, the mine, with its main corridor and its lateral chambers would look not unlike a long bridge, with frequent supports, laid over on its side. The coal is mined in seams reached by shafts and slopes, down which the men go, and out of which the coal they dig ascends. In the future it is believed that some shafts will sink down into the earth as much as 6000 feet.

The coal is either blasted from the face of the seam or under-cut first with electric drills and then "shot." In the blasting or shooting, regulations provide permissible explosives with a view to minimizing the danger of this work underground. Once on the surface the coal must be broken and sorted. Large tipples or breakers separate the slate and waste matter. In the anthracite industry the sorting is into the domestic sizes of stove, egg, nut and pea coal for the retail market. The residue of fine coal, amounting to thirty or thirty-five per cent is used for steam purposes, competing with soft coal. Grading in this manner also obtains in the bituminous fields, where the low-volatile fuel is gaining currency for



PRODUCTS OF SOFT COAL

The by-products of coal are numerous and there is a sample of each of them in this exhibit in the United States National Museum.

(Continued on page 54)

ANIMAL TRAILS AND TRAILING

By L.W. Brownell

HAVE you ever followed the trail of the wild through the winter's snow? Can you distinguish between the tracks of the mink and the muskrat, the fox and the dog, the rabbit and the squirrel? If not, you have missed much that is interesting and enjoyable in the outdoor life of winter.

To any who studies the movements of our wild animals the winter season offers the greatest opportunities, for at no other season does an animal leave behind him so clear a record of his wanderings as when the snow covers the ground. When the snow is damp and not more than two or three inches deep the tracks are clear and well defined and the tale of each animal's journeyings may easily be read by him who is at all familiar with the little people of the wild. It is when the snow is deeper and dry that the story becomes more difficult, for then the tracks are blurred and sometimes more or less obliterated by the drifting snow, and even a wise tracker may often be at a loss to know what animal has made a particular set of tracks.

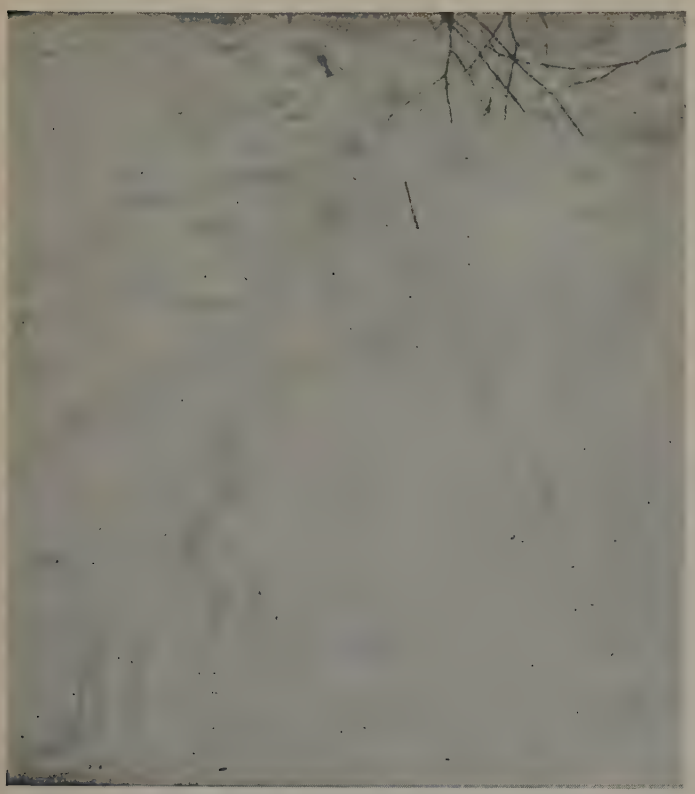
Early morning is the best time to follow the trails. Then the sun has not gained sufficient strength to blur them by melting the snow. The ideal morning is one following a clear night preceded by a light fall of snow the evening previous. On such a night most of the little kindred of the wild are abroad, especially if it is moonlight. In searching for their tracks the next morning one cannot go amiss, for they are everywhere, in both the fields and the woods, crossing and recrossing each other in a regular maze. One who is an adept in the use of his eyes may read a story in these tracks, both comedy and tragedy.

It was after such a night, on a clear, frosty morning, that I took my camera and started out with the intention of preserving some of these records in the shape of photographs, and I am going to tell you something of my tramp and show you some of the results in this article.

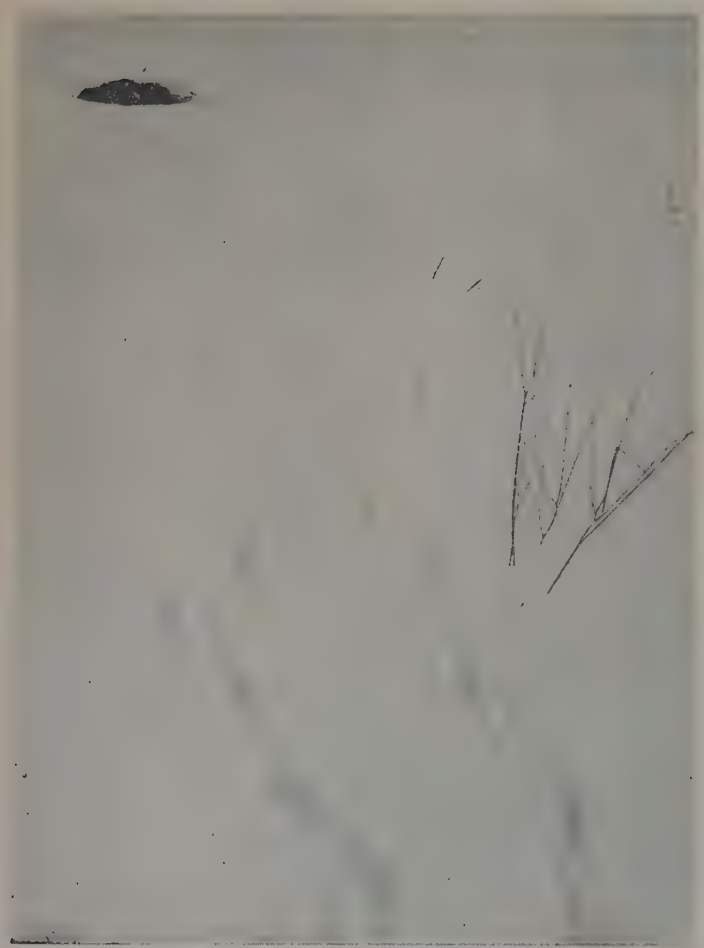
In the very first field which I entered I found my first track, that of a dog. Although this was not

TRACK OF DOG TRAVELING AT AN EASY TROT

A FOX PASSED HERE AT ANY EASY LOPE

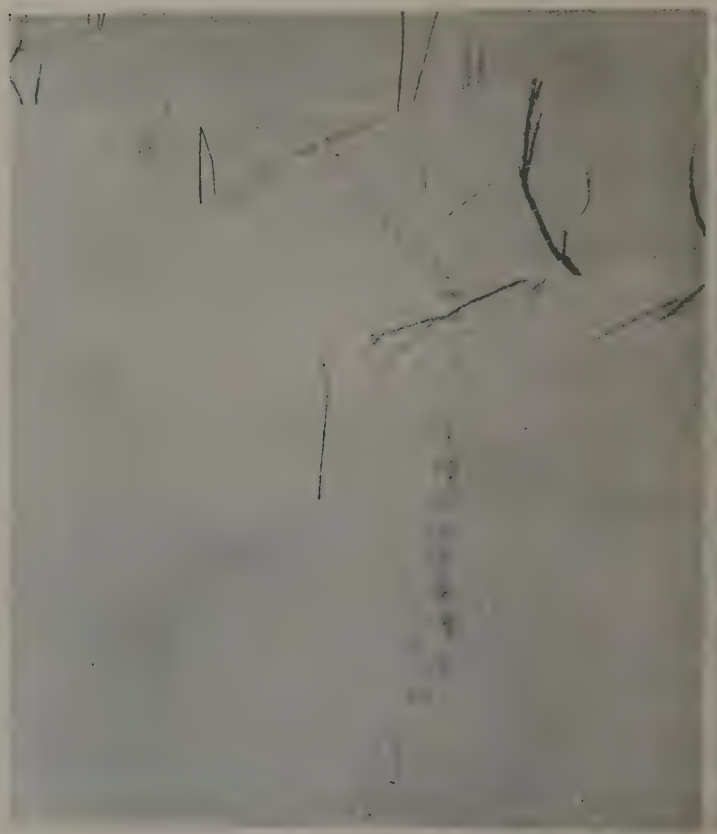


WHERE THE WHITE-FOOT FORAGED FOR HIS MIDNIGHT MEAL OF BIRCH SEEDS



HERE A MUSKRAT HAS LEFT HIS BURROW IN A LEISURELY MANNER, RETURNING IN A HURRY

the track of a wild animal let me say, before going any further, that he who would make a good trailer must not scorn to study the tracks of the cat and the dog. He will find them everywhere throughout the fields and even in the deeper woods, and he must be able to distinguish them when he sees them and not mistake them for the tracks of some other animal, else he will frequently find the trail he is following end in some farmyard. In fact, the track of a fox and of a dog of about the same size are so very similar that even a seasoned trailer may be excused for sometimes confusing them. The only difference that I have ever been able to determine is that, possibly, the tracks of the fox are a trifle



THE DAINTIEST TRACKS OF THEM ALL, MADE BY THE LITTLE SHREW

more nearly in alignment, but I am far from certain that this holds good in all cases. In fairly deep snow, however, the fox is likely to leave tail marks from the dragging of his brush, which the dog seldom does, and this is usually a distinguishing feature. In light snow, however, this is not so apt to offer a means of identification.

In this instance the dog was undoubtedly a hound and was traveling at an easy trot, dragging his feet through the snow at each step, apparently upon no important business. He had ambled along to the river's edge, where he had stopped for a drink, and from there his trail turned homeward, and so I followed this particular animal no longer.

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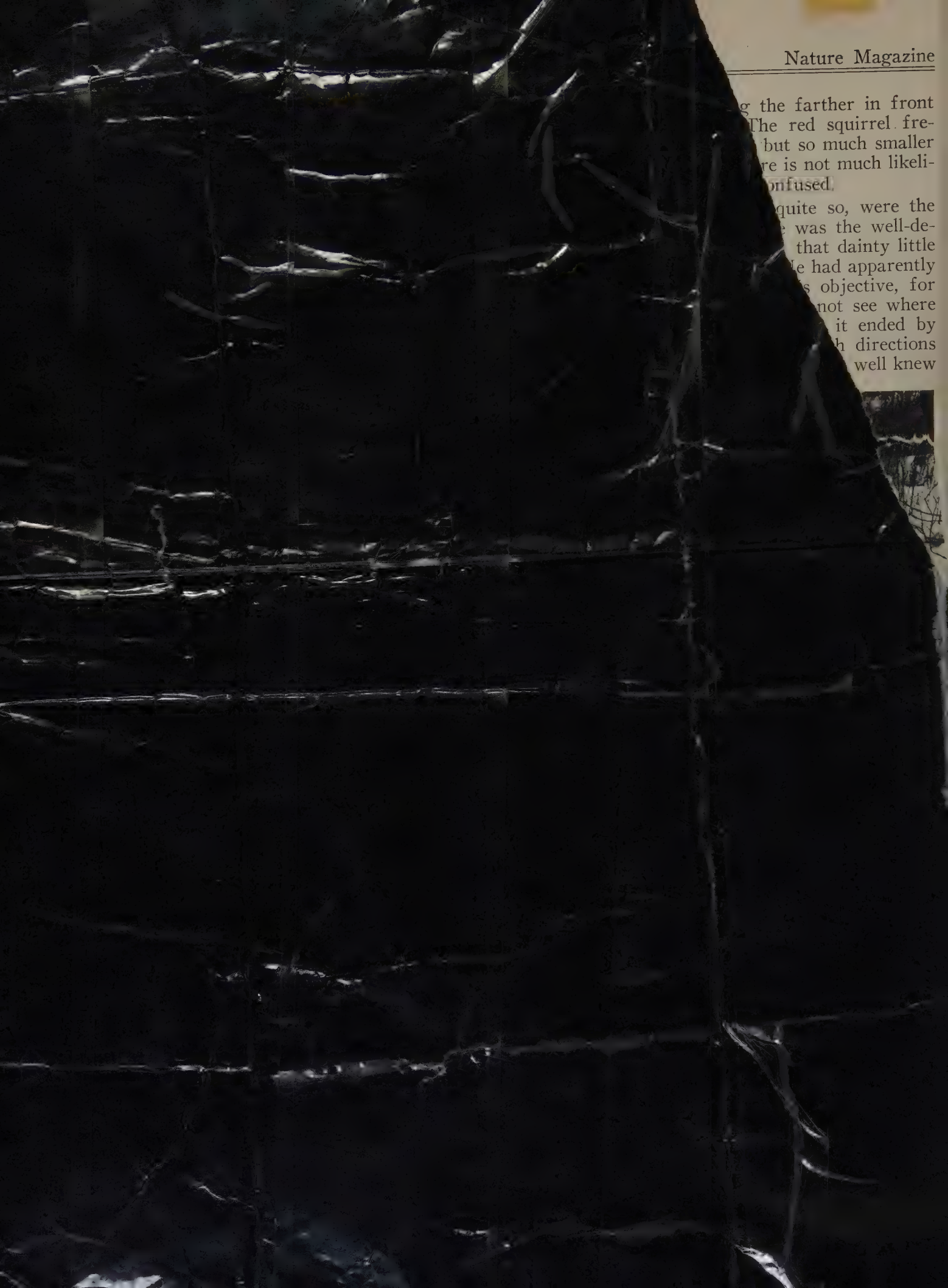
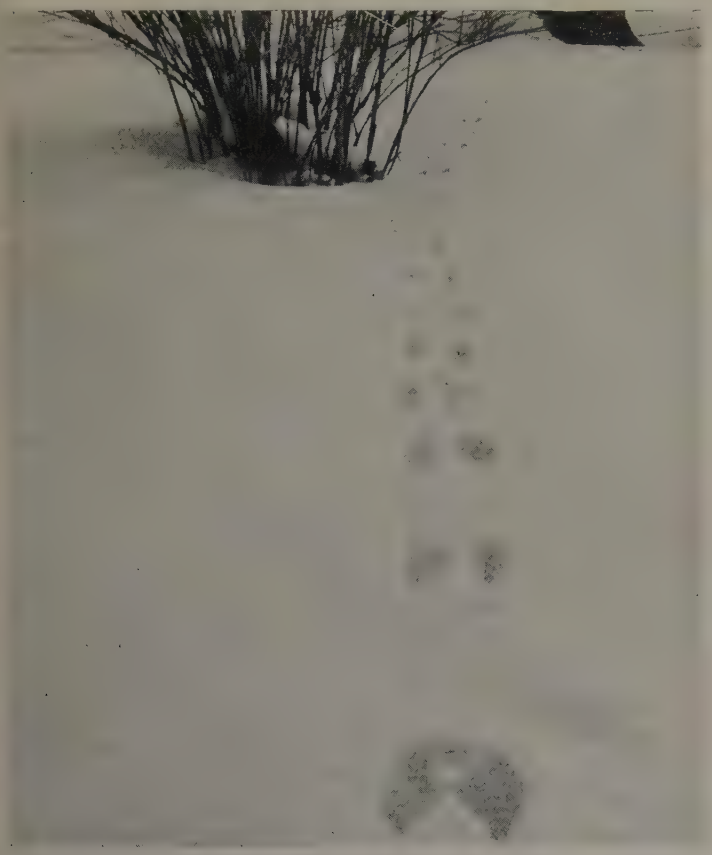


bushes, and I knew that for this time, at least, the little white-foot was safe at home.

When one follows the trail of a white-foot it is not always that he finds the story ending so peacefully, for very frequently we find the tracks ending in the all too apparent evidence of a tragedy. The marauding owl, weasel or fox is ever upon the alert



TRACK OF GRAY SQUIRREL IN DEEP SNOW

for these, to them, toothsome and delicious little additions to their nightly bill-of-fare.

The track of the meadow mouse is somewhat larger and coarser and more apt to be found in meadows than in the drier woods and fields that the white-foot inhabits. Upon entering a small piece of marshland I came across one of these tracks, the maker of which had evidently started out upon a foraging trip, but had turned back in a hurry, scared by something he had heard or seen. A little further along, however, I found where some of these little fellows had literally ploughed up the snow in their search for seed.

The daintiest track of them all is made by the little shrew. In fact, so delicate and fine is it that the snow must needs be in just the right condition of body and depth to record it at all, and lucky indeed is the trailer who can find one sufficiently well-defined to follow for any distance. It bears a close resemblance to the track of the white-foot, but is much smaller and more delicate in every respect.

Climbing a hill I came upon the track of a mink who had evidently crossed the ridge in somewhat of a hurry. Here the snow was fairly deep which necessitated the animal taking moderately long leaps. The imprints of his feet were quite far apart and the dragging of his tail in the snow showed very plainly between them. Just what his object was in crossing this hill from one piece of lowland to another, and why his hurry, I could not determine, although I followed his tracks until I lost them in a piece of ground thickly covered with a dense and heavy growth of brush.

Descending into a piece of swampland, where the ice was but thinly covered with damp snow, I came upon the double track of a muskrat. He had left his burrow in a leisurely manner, but had returned in a hurry with long jumps. Curious to learn what had so frightened him, for frightened he doubtless was, I followed the outgoing trail until I came to the spot where he had stopped and then started back again in long leaps. There, a short distance beyond, I saw the trail of a fox running at right

DOUBLE TRACKS OF GRAY SQUIRREL COMING AND GOING IN LIGHT SNOW, SHOWING FOUR IMPRINTS

angles to that of the muskrat. The scent, or the sight, of the muskrat had evidently been the keener of the two, for the track of the fox did not swerve and he had undoubtedly been entirely unaware of the near proximity of one of the animals which he was hunting, which was lucky for the muskrat.

As I again climbed to higher ground I found

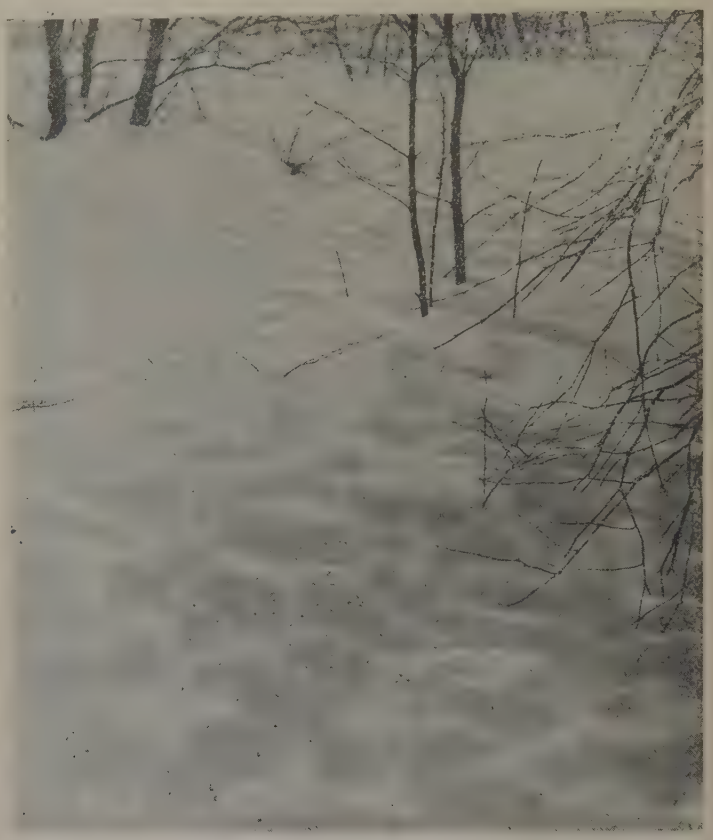
where a crow had alighted and walked a short distance before again taking wing. The imprint of his wing feathers was plainly visible at the point where he came to earth, showing that the tips of his wings must have struck the snow lightly as he lit. From there his tracks led up a short incline for a distance of ten or twelve yards to the foot of a small tree, where they abruptly disappeared. Whether the crow had hopped upon one of the lower branches of the tree or taken flight directly from the ground, and what his object was in alighting at all, I could not determine.

Not far from here I crossed the track of a

WHERE A CROW HAS ALIGHTED AND WALKED A SHORT DISTANCE BEFORE AGAIN TAKING FLIGHT

prowling cat. Pussy's trail is, usually, easily distinguishable for, unless in a great hurry, which she seldom is, she travels at an easy trot, each foot following the other in exact rotation, and falling upon the same spot, thus forming a single-footed trail in which the imprints are in almost perfect alignment. As she was headed toward a house in the near distance I concluded that her trail could offer me no real inducement for following it, so passed on.

On the way home I visited a park, where the gray squirrels were numerous and where I knew that I could, with no effort, find plenty of their tracks, and in this I was not disappointed. The gray squirrel progresses in much the same way as does the rabbit, by leaps, and, at each leap, throws his hind feet in front of his forefeet. The differ-



WHERE THE MEADOW MICE FORAGED FOR THEIR FOOD

ence in the tracks of the two animals lies in the fact that the forefeet of the gray squirrel almost invariably land parallel with each other and not one behind the other, thus making an imprint consisting of two parallel footprints, immediately behind which are two others, also parallel, but much smaller than the first pair. These four impressions are clearly discernible when the snow is soft and not more than a couple of inches deep, but when it is deeper they show only as two parallel holes.

The Wonders of Orion

By ISABEL M. LEWIS

United States Naval Observatory

ORION, most glorious of all the constellations, may be seen rearing his huge, majestic form high above the southeastern horizon in the early evening hours of January. Two stars of first magnitude are in this group, Betelgeuse, the youthful red giant, of which we have heard so much in the past few years, and the magnificent Rigel, an extremely hot and massive bluish-white helium star, a true diamond of the sky. In addition to these there are five stars of the second magnitude, a number of third and fourth magnitude, and a nebula, visible faintly even without the aid of a telescope, that is universally acknowledged to be the finest object of its kind in the heavens.

In Orion the ancients saw a mighty warrior and hunter, of ill-repute among classic writers because with his appearance they associated the storms which were so prevalent at this time of year and so dangerous to seamen. Old star-maps pictured Orion with a lion's skin thrown over his left shoulder and uplifted arm, represented by a line of faint stars running westward and northward from Bellatrix, the star in the left shoulder.

A second line of faint stars running from Betelgeuse in the right shoulder toward the northeast and then turning sharply westward to a point near the tip of The Bull's horn, represents the uplifted right arm and the club which he is brandishing. Three stars of the fourth magnitude in a small group above and midway between Betelgeuse and Bellatrix mark the head of Orion. In the left foot is Rigel and in the right knee, Saiph, for the right foot is concealed from view behind the small constellation of Lepus, The Hare, to the south.

The three stars of second magnitude in a straight line exactly three degrees in length, with stars set a degree apart, form the Belt of Orion by which we can so readily distinguish this noble constella-

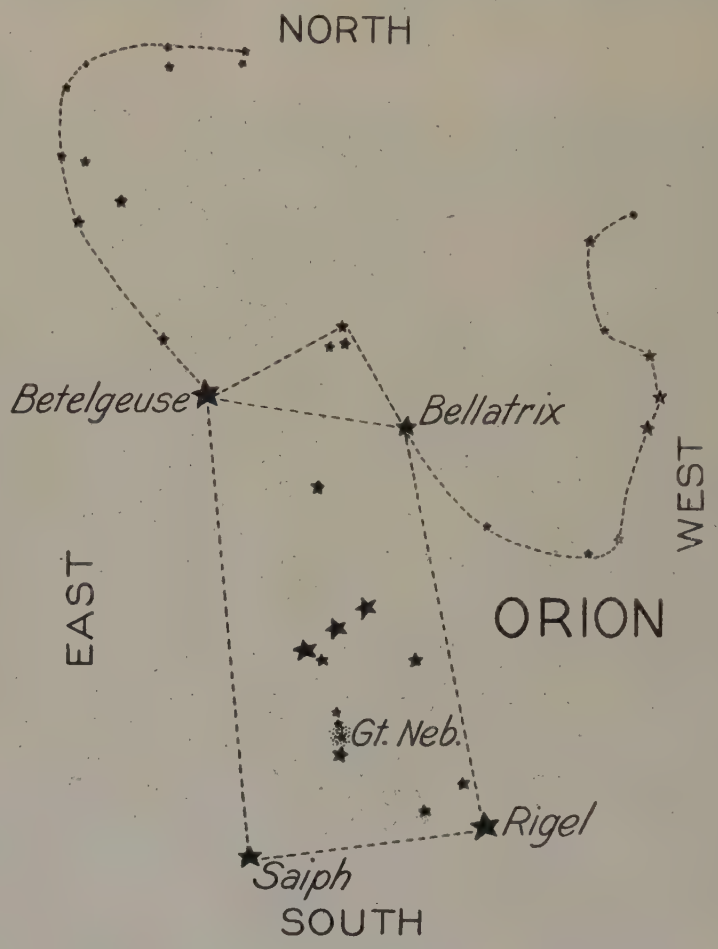
Taken at Mount Wilson Observatory—Exposure three hours

THE DARK BAY OR DARK HORSE NEBULA IN ORION

Note the resemblance of the projecting dark cloud to a horse's head and mane, also the great extent of the dark nebulous field on the right and its absorption of the light of stars beyond it, as indicated by the difference in the number of stars which are to be seen to the left and right of the center.

tion. These three stars have also been called, popularly, the three Magi, or three wise men from the Orient, as well as the yard and ell of merchants and the golden yardarm of sailors. The celestial equator passes just above the star that is farthest north, and so, at the earth's equator, when Orion is on the meridian, this star is almost exactly in the zenith. Owing to its central position on the equator Orion is visible in all lands, though at this time of year when it appears to us on clear, cold, wintry evenings high in the southeast the inhabitants of the southern hemisphere see it in the northeast on their midsummer evenings.

Dependent from the Belt is the Sword of Orion, and in the center of the line of faint stars that outline the Sword is a somewhat fuzzy star which is all that can be seen, without a telescope, of the Great Orion Nebula with the multiple star Theta embedded in its heart. Even a small telescope will give an admirable view of this greatest of nebulas and will separate the star Theta into four distinct stars forming the well-known "trapezium." More powerful telescopes show Theta to be a sextuple star or, in other words, a group of six stars held together by their attraction for one another and in revolution about a common center of gravity.



ORION, THE GIANT WARRIOR AND HUNTER

To view this group hold the chart inverted with top toward the north. Orion will be found in the southeast in the early evening hours of January. The three bright stars, of second-magnitude, in a straight line and equally spaced, which form the Belt of Orion, are alone sufficient to identify the constellation.

All the devices of modern astronomy, not only powerful telescopes, but spectroscopes, photographic attachments, highly sensitive heat-measuring instruments, and interferometers for measuring the diameters of the stars, are being employed at great observatories in many lands to explore the mysteries of space and unlock the secrets of the heavens. As one of the results of this work we know far more of the wonders of Orion today than we did even ten years ago.

It is now known that all the principal stars in Orion, with the exception of the red, giant star Betelgeuse, form an enormous group of stars like the Hyades and Pleiades, of which we wrote last month, only the Orion group is far more extensive than either of these clusters and far more distant. The great nebula, densest in the vicinity of the star Theta, is not confined to this region alone. Its whirling folds and spiral streamers involve the entire constellation. The three stars of the belt lie along one of these extensions of the Great Nebula; and south of the easternmost star, Zeta, is a wonderful region of dark and luminous nebulous clouds which shut off the light of stars beyond.

The portion of space in which the stars of Orion were originally formed must have been abundantly supplied with the stuff of which stars are made, for most of the brighter Orion stars have one or more companion stars. Theta, in the heart of the Great Nebula, is, as we have said, a star made up of six stars. Just to the south of this star is Iota, a triple star. The magnificent Rigel has a faint companion easily discovered with a small telescope. The westernmost star in the belt is a double star, the easternmost is triple, and Sigma, a little to the south of it, is also made up of three stars. So we might go on, for Orion is a veritable mine for such objects, many of which are easily separated with small telescopes. It was at one time thought that the stars of Orion were being formed from the Great Nebula and its ramifications. The stars of Orion are mostly of the same type, intensely hot, luminous and massive bodies. At one time they were believed to be the youngest of the stars, but it is now known that they are at the height of their evolution and their nebulous surroundings are the product of such stars rather than their source. The intense light-pressure that exists within these tremendously hot and massive stars drives off from their surfaces the minute particles of which their nebular

Taken at Mount Wilson Observatory—Exposure three hours

THE GREAT NEBULA IN ORION

This nebula is generally considered to be the finest object of its kind in the heavens. It is sometimes called the "fish-mouth nebula" from the fancied resemblance of the dark nebula, leading up to the trapezium of stars in its brightest portion, to the mouth of a fish.

surroundings consist. Most of these nebulous clouds are dark, but when electrically excited by the nearby stars they become luminous. We have already seen an instance of this association of stars with nebular surroundings in the case of the Pleiades, but the Great Nebula of Orion is far more extensive and wonderful in form than the nebulosity in the Pleiades.

There is some uncertainty as to the distance of the Orion stars, but it is known to be much greater than that of the Pleiades and Hyades and the most reliable estimate is about six hundred light years. If we prefer to think in terms of miles, which is not a very wise thing to do when speaking of star-distances, we find that this is equal to about thirty-six hundred trillion (3,600,000,000,000,000) miles, or nearly forty million times the distance from the earth to the sun! With its tremendous speed of 186,000 miles in a second, light takes six centuries to cover this distance.

The red star Betelgeuse, varying irregularly in brightness, is not a member of the Orion group but, as its color indicates, is a star of an entirely different type. Its distance of 160 light years is only about one-fourth that of the Orion group, but still sufficiently great to be staggering.

Owls on the Night Shift

By WILLIAM L. and IRENE FINLEY
National Association of Audubon Societies
(Photographs by William L. Finley and H. T. Bohlman)

FOR ages, the owl has been regarded with superstition, an ill-omened bird of prey. Perhaps it is not unnatural that we take a dislike to a fellow who is up all night and is sleeping during the day. There is always a suspicion against a night prowler whether he be bird, beast or man. Yet as long as we have a great army of ground folk that ravage our gardens and orchards at night, we must have night watchmen or policemen to keep these robbers in check. If the gophers, squirrels, mice and rats had free rein, they and their children would soon take almost everything. In fact, they would nearly eat us out of house and home.

To prevent such a calamity, Mother Nature has put the owl on the night shift. She has equipped this bird in a wonderful way for his life work. The eyes of an owl are not in the side of the head like those of a sparrow, but they are fixed in their sockets in front in a peculiar way, so that the bird cannot look in different directions without turning his head as a person does. The eyes of a barn owl are in the center of two circles of filmy feathers, with a hooked beak between, creating an expression not bird-like, yet not quite human. The vision is so keen that an owl detects the slightest movement. The bird is often called the monkey-faced owl, because of his odd appearance.

Some owls have tufts of feathers above the eyes which can be raised or lowered. Since these give the appearance of ears, some people have the idea that these are in some way a part of the real ear; but the strange formations have no real connection with the hearing. These feathered tufts or horns serve merely as ornaments. The ear opening is large and the hearing is keen enough to catch the footsteps of ground animals that move around on the hunt. It is likely that an owl can hear a mouse further than he can see it.

The clothing of an owl is loose and fluffy, making the bird appear larger than it really is. The feathers are soft and fringed. Even the strong wing feathers are edged with down so that flight is noiseless when the owl flaps over a field. In this way rodents have no warning of his coming. His claws are pointed like needles and have the strength of a steel trap. They pierce the small ground animals with little effort and the flesh is torn by the hooked beak. When an owl pounces upon a squirrel or rabbit, the animal appears to be terror stricken. The owl strikes for the head and neck. As a general rule, he eats the head first.

A young owl has a big appetite. He will eat his own weight in food every night, and more if he can get it. There is a case on record where a half-grown barn owl was given all the mice it could eat. It swallowed eight one after another, and the ninth followed, all but the tail, which for a time hung out of the bird's mouth. In a few hours this same bird was ready for a second meal and swallowed four more mice.

An owl is not particular when he eats. He tears a small animal to pieces, swallowing meat, bones, fur and all. The nutritious parts are absorbed in the stomach and the indigestible matter is formed into oblong pellets and disgorged. About any owl's roost or near its home, one may find numbers of these pellets. A scientist by examining these can tell exactly what the bird has been eating and can make a fair estimate of the size and number of the owl's meals.

The best known record of this kind concerning the food of the barn owl was that which was made from a pair that occupied one of the towers of the Smithsonian Institution at Washington. Dr. A. K. Fisher, who is our greatest authority on the food of hawks and owls, collected and examined 675 pellets. These showed that the owls had eaten 1596 mice, 134 common rats, 54 shrews, and 37 other mammals and birds. From this menu, any person can see that these owls are worth a great deal about the community where they live.

It is not surprising that some people shudder at the night call of an owl. Some owls have weird sounds like the wail of something lost. Yet to one who understands the language of the owl, it is not at all uncanny. The musical whimper of the screech owl, the deep hoot of the great horned owl, and the scream of the barn owl are all interesting sounds of the night. We live so much in the glare of daylight that we never get acquainted with many furred and feathered folk that live in the dark.

About two hundred different species of owls are found in various parts of the world. About twenty of these inhabit North America. As a rule, they are birds of the woods, but some live on the open marshes and plains, others around old buildings. The tiny elf owl of Arizona is about the size of an

(Continued on page 28)

THE SCREECH OWL

The call of this little owl is not a screech, as one might think from its name. It is a series of short whistles or sometimes a quavering whimper which is a pleasing note to those who know the bird. He is found in all parts of the United States, especially about old apple orchards where there is a hole for an owl home. He is of economic value about any garden or orchard and should be protected.

A YOUNG LONG-EARED OWL

In his downy stage, the ear tufts have not yet developed on his head. The clothing of an owl is loose and fluffy making him appear larger than he really is. The wing feathers are edged with down, so when he flies there is no noise like cutting the air with a whip. This noiseless flight enables him to fan over the fields without being heard by the little ground animals.

HE MIGHT PASS FOR A PROFESSOR

Contrary to general opinion, owls see very well in daylight. Their eyes are far more perfect than those of man. They can be adjusted to detect the slightest movement of a mouse in the darkness of the night. The ear is hidden in the filmy feathers on the side of the head near each eye. The opening is large and his organ of hearing is as keenly developed as the organ of sight. It is very likely that an owl can hear the movement of a mouse further than he can see it.

THE BARN OWL TRIPLETS AT THE AGE OF SIX WEEKS

For ages the owl has been regarded with superstition, perhaps because he works on the night shift. Yet he is the policeman who protects our gardens and orchards from the great army of ground folk like mice and squirrels.

TWO MONTHS OLD AND FULLY GROWN

A barn owl will eat its own weight in food in one night, which is far more in proportion than a man can eat. In one case a young barn owl was kept in captivity and given all the mice it could eat. It swallowed eight, one after another, and the ninth followed all but the tail, which for a time hung out of the bird's mouth. In a few hours the same bird was ready for a second meal and swallowed four more mice.

ALL DRESSED UP AND READY TO GO

The eyes of the barn owl are not in the side of the head like the sparrow, but in front like the eyes of a man. They are in the center of two circles of filmy feathers creating an expression unbirdlike, yet not quite human. He is often called the monkey-faced owl.

No. 1—BARN OWL ALIGHTING

An owl is not particular what he eats. He swallows meat, bones, fur and all. The nutritious parts are absorbed in the stomach and the indigestible matter is formed into oblong pellets and disgorged. About any owl's roost or near its home, one may find pellets and by examining them a scientist can tell exactly what the bird has been eating. Dr. A. K. Fisher, who is our greatest authority on the food of hawks and owls, collected 675 pellets from a pair of barn owls that lived in one of the towers of the Smithsonian Institution at Washington and these show that the owl had eaten 1,596 mice, 134 common rats, fifty-four shrews and thirty-seven other mammals and birds.

No. 2—DOWNY BARN OWLS ABOUT THREE WEEKS OLD

If there were a circus in the bird world, the barn owls would be the biggest clowns in it. The more natural they act, the funnier they look.

No. 3—ANOTHER VIEW OF THE BABY DOWNY BARN OWLS

They bow and blink at everything they see, and on closer acquaintance they snap their bills and hiss like a box-ful of very active and energetic snakes.

No. 4—PREPARED TO MEET STRANGERS

If cornered an owl protects himself by rolling over on his back and putting up his claws. The claws are pointed like needles and have the strength of a steel trap. His grip is death to small animals. Then he uses his strong hooked beak to tear the flesh. He strikes for the head and neck of a gopher or squirrel and generally eats the head first.

Forest Production--Words or Actions!

By CHARLES LATHROP PACK

President of the American Tree Association. Author of "Trees as Good Citizens" and "The School Book of Forestry"

LESS talking and more doing. Agreement instead of argument. Wood, not words. Policy in the singular and cooperation in the plural. These are logical campaign slogans for an aroused public opinion that realizes that millions of idle acres do not build homes.

Gradually there has arisen a popular demand for a real forest policy—workable and economically sound. More and more attention has been devoted in press, in magazines and in books to the fact that forests are vanishing. Increasing numbers of words are being written about the need of action. All this is valuable and admirable, but there is a woeful lack of agreement on what to do and how to do it.

First there must be agreement on what forestry is, and is not. It is not a law making a man plant a tree every time he chops one down. It is not placing his woodlands, or anybody's else woodlands, under the arbitrary control of some public commission or other. It is not Uncle Sam playing a fire hose on a blazing brush pile, although fire protection is a part of sensible forestry. It is the use of scientific principles in growing timber. It is setting lands that will not grow anything else but timber to work growing trees. It is raising wood crops to the mutual advantage of both producer and consumer.

A forestry program does require a law because it must have government cooperation. Official example and partial government participation are essential to the scientific growing of a crop of big timber, which must grow for more than the active life of a generation. This partial help is necessary, although a policy of public ownership of the entire forest area of any country is unnecessary and undesirable. In France this cooperation by public ownership amounts to thirty-five per cent of the total forest area, in Germany fifty-three per cent, in Sweden twenty-four per cent, and in the United States twenty per cent. Our public area, however, is geographically unbalanced with seventy per cent of the forest west of the Rockies publicly owned and only three per cent for the rest of the country. A real forest policy should aim at public ownership of forty per cent of the area, acquiring the most of it east of the Rocky Mountains.

There remains sixty per cent of our forest area. What of this? It is likely always to remain under private ownership, but any adequate forestry program must provide that timber be produced permanently on these areas. Every European nation accomplishes this end by showing the private owner that it will pay him to administer his holdings in the right way. They proceed on the theory of a fair return for the work and risk involved in proportion to that which may be obtained in other lines of industry.

Such a policy means different methods of taxing forest lands than are now generally found on the statute books of our states. Taxes must not be so levied as to eat up the investment. They must encourage instead of discourage. They must he held in abeyance, at least in part, until the crop is matured and can be sold. Otherwise the owner will let the land lie idle, and idle land does not enrich the coffers of any political unit. A glance at the tax rolls of Michigan and Pennsylvania is enough to convince any tax authority that delayed taxes are better than none.

Then, the forest owner must be shown how. This is a matter only for the proper and duly authorized government agency, supported by sufficient appropriations. This agency can be best equipped to determine what kind of trees should and should not be grown on our variety of essentially different forest regions. It can set forth the relation between timber production and varying conditions of soil. It can tackle the problems of wastage.

Eighty-one million acres of former forest land are now denuded—an economic liability. They are fitted for no other practical use save the growing of trees. They cannot be brought back into forest production without planting and regeneration on a large scale by both federal and state agencies. This constitutes an important phase of any proposed legislation for a forest program.

Hearings have been held from coast to coast by the Committee on Reforestation of the United States Senate. These hearings have resulted in the presentation of overwhelming evidence in support of the points already made in this article. There only remains to be determined just what immediate steps should be recommended to Congress.

Recently Mr. R. S. Kellogg, chairman of the National Forestry Program Committee, appeared before the Senate Committee in Washington, offering definite and distinct recommendations. As an immediate program he advocated the appropriation by the National Government of not less than

$1,000,000 yearly for cooperation with the states in fire prevention; $5,000,000 annually for the purchase of forest lands upon watersheds of navigable streams; $1,000,000 a year for forest research and inquiry, including studies of taxation, and $100,000 a year for forest planting in cooperation with the states and otherwise, this appropriation increasing to $1,000,000 within ten years. He also proposed that the Secretary of Agriculture be authorized to determine what land owned by the United States and not now in the National Forests or National Parks, is chiefly valuable for protection of watersheds in order that they may be administered in a way best to protect the public interest.

In suggesting these Federal appropriations, the National Forestry Program Committee does not imply that the chief duty rests with the Federal government, but only the initial duty to help stem the present wasteful tide. These appropriations, supplemented by the states, especially east of the Rocky Mountains, will arouse and stimulate the private owners, helping them to see how to raise timber at a profit, as the agricultural experiment stations and farm bureau agencies show the farmers in the matter of other crops.

These points, Mr. Kellogg told the committee, would lead to an ultimate program under which the requirements of each forest area would be determined, sufficient money would be available to make these requirements available, and our forest resources and land would be classified. Adequate research would be made into timber production and utilization, he said, forest planting would be under way on a large scale, better systems of forest taxation by the states would be in vogue and the public forest domain would be gradually built up to forty per cent of the total area.

Here, at last, is a simple and concise program agreed upon by leaders of wood-using industries, professional foresters and associations interested in forest conservation. This program is neither violently radical nor insipidly over-cautious, but a fair well thought-out and thoroughly considered plan for action. It may not be perfect in every detail, but it does make a positive start in the right direction, and if we are to wait for the perfect and ideal forest policy our forests will be all gone and the people of our nation helpless. Timber will not be grown by private owners unless it pays to do so. Private forestry as well as public forestry pays in the leading countries of Europe. Their laws make it possible; ours do not. Private capital in those countries is devoted to the growing of timber and cooperates with the public authorities in so doing because capital gets a fair and safe return therefor. Private capital will do the same in our country with the same opportunities. It is the duty of the nation to see that these opportunities are given.

Owls on the Night Shift

(Continued from page 20)

English sparrow. I have found many of them nesting in old woodpecker holes in the giant cactus. The pigmy owl is a little larger, and while many people think that an owl cannot see well during the day, yet this little fellow often hunts in broad daylight. The short-eared owl is also a bird that flies over the field in broad daylight and hunts very much like a hawk. It nests on the open ground in a field. The burrowing owl is a little fellow often seen during the day on the plains in the west and south, where he sits at the mouth of an abandoned hole of a squirrel or prairie-dog. He nests from three to six feet under ground. The long-eared owl and the great horned owl are birds that often nest in an abandoned crow's or hawk's home. The latter is the largest and most powerful of the commoner owls through the United States. The snowy owl of the north is also a large bird and is sometimes almost pure white in winter. In very cold weather and when food is scarce in the very far north, he may be found wintering in the northern part of the United States, but as a rule he is not a regular visitor, as he prefers the colder climate of latitudes above the Canadian border.

Yes--We Have Some Bananas

By N. C. McLOUD

TO most of us the banana is simply the golden yellow fruit seen in great bunches in the fruit stalls or temptingly displayed on the push-carts of the peddler. To the botanist it is the product of what is perhaps the largest known plant without a stem of wood—an interesting member of a useful and widespread family. To the expert in food economics it is a fruit of profuse growth excelling even wheat in food production to the acre.

The history of the banana as an article of daily diet goes back into remote centuries in the civilization of the eastern hemisphere.

Some authorities say that this fruit was introduced into the New World during the rule of the Spanish, about the first century after the discovery of America by Christopher Columbus. Other students assert that the banana was known to tropical America hundreds of years earlier.

In any event the banana today is the foundation of an enormous industry, giving employment to thousands and supporting organized enterprises of vast commercial importance. The banana trade involves the building of railroads, the operation of great fleets of steamships and the maintenance of highly specialized machinery of commerce covering a generous part of the tropics of the world. In still other areas of the torrid zone, where the export trade has slightly penetrated, the growth of bananas for local food supply makes a belt which almost completely encircles the earth.

Tradition and legend are embodied in the very names of the several varieties of the species Musa to which the banana belongs. The banana as we know it is Musa sapientum, representing the "Fruit of Knowledge" of ancient India. Another variety is Musa paradisiaca, with legendary identification as the Fruit of Paradise of the Garden of Eden. The golden yellow fruit of our markets and the red

MANZANA (APPLE) BANANA, OF PORTO RICO

There are many varieties of bananas and this one grows under the American flag. Until ripe the apple banana is as unpalatable as a green persimmon, because of the presence of tannin.

bananas we sometimes see are both members of the former variety. The red banana is pleasing to the palate, but it has never made much headway in competition with the yellow fruit to which Americans are accustomed.

The banana market of the United States draws its supply from the Central American countries extending from southern Mexico to Panama, lapping over into Colombia, and reaching out to the West Indies. Honduras, Nicaragua, Costa Rica and Panama are especially heavy contributors. In the

Courtesy United Fruit Company

THE ROOT SYSTEM

Close-up view of the roots of the banana plant. Five of the eight "sword-suckers" are shown.

Costa Rican province of Limon, alone, almost 20,000 British West Indian negroes are said to be employed on the banana plantations. Costa Rica's banana industry occupies an area of some 100,000 acres, and is the major activity of the country.

While commonly spoken of as a tree the banana plant is merely a collection of leaf sheaths, tightly enwrapped into form which gives the appearance of a trunk. The growth comes from the center of the mass of leaf sheaths, the young growth forcing the older ones outward. The entire growth emanates from a rootstock, with eyes like the Irish potato, and requiring similar treatment in planting. Each piece of the bulb-root must contain an eye when planted. The weight of the pieces used for propagation is from three to four pounds apiece,

Courtesy United Fruit Company

GROWTH OF SIX MONTHS

The development of the banana plant is rapid and by the end of a year reaches twenty to forty feet.

ranging upward to eight pounds for new planting.

The growth from the bulb-root is extremely rapid. The first leaves to make their appearance are closely inter-wrapped, and grow straight upward to a sharp point. With the growth of the leaves, and the appearance of new ones, the stalk quickly reaches a height of several yards. The trunk-like mass ultimately grows to a height as great as forty feet under favorable conditions of soil and climate, and may attain a diameter of two feet. This extreme development is found in the low-lying lands of Costa Rica and other Central American states. In the islands of the Caribbean the usual height is generally half as great, and often not more than twelve or fourteen feet.

From the top of the closely rolled stem the leaves themselves develop into fronds suggesting those of the canna, but on a vastly larger scale. These giant leaves grow to lengths of ten feet or more. They

Courtesy United Fruit Company

RAILWAY THROUGH BANANA PLANTATION

Prompt and economical transportation to the seaboard requires the building of railroads through the banana plantations. Over these tracks fruit trains constitute the principal item of traffic.

Courtesy United Fruit Company

WHERE NO RAILWAY IS TO BE FOUND

In many parts of the plantation there is neither railway nor vehicle route, and the fruit is "packed" by mule-power to the nearest tramcar, for dispatch to the railway line and then to the seaboard.

are often twenty-four inches wide. They show little tendency to droop, and remain nearly vertical. A tree bearing a dozen or a dozen and a half of these leaves is like a highly decorative palm.

Courtesy United States Department of Agriculture

IN THE HEART OF THE PLANTATION

This picture gives an idea of the dense tropical growth of the plant of Musa sp. in Siam.

The initial stage of the bunch of bananas is a flower bud. This grows from a central stem which forces its way through the "trunk" to the extreme top. This flower-bud has a husk, which falls away revealing the tiny bananas in the form of a miniature "bunch" with its small fingers outstretched. As the fruit grows the individual bananas curve upward. To the visitor, familiar only with the bunches as seen in the market, they appear to be growing upside down.

Are you surprised to learn that a plant produces but one bunch of the fruit? As nature's compensation for this exclusiveness, provision has been made for permitting the plants to grow closely to one another. This solves the problem of space for cultivation of the plantation.

The rapid growth of the plant, from root-stock to finished bunch, is amazing considering the size of the vegetation. It is a development possible nowhere but in the tropics and results from rich, moist soil, with heavy rainfall and extreme humidity. The initial leaf shoots appear above the ground within less than a month after the root-bulb has been planted. Full height is attained within a year, preceded a few weeks by the appearance of the flower-bud. Development of the fruit to the point at which it is ready for harvesting is a matter of a few months more. The complete cycle covers a period of from slightly more than a year to fifteen

IN UNFAMILIAR POSITION

The banana does not grow in the drooping position of the market display. The tips point upward.

or sixteen months—a life history surprisingly brief for so large a growth.

With modern organization has come complete revolution in the methods of cultivating bananas. The raising of this fruit is no longer a haphazard process of nature in the midst of a tangled wildwood of the tropics. The rank growth of the

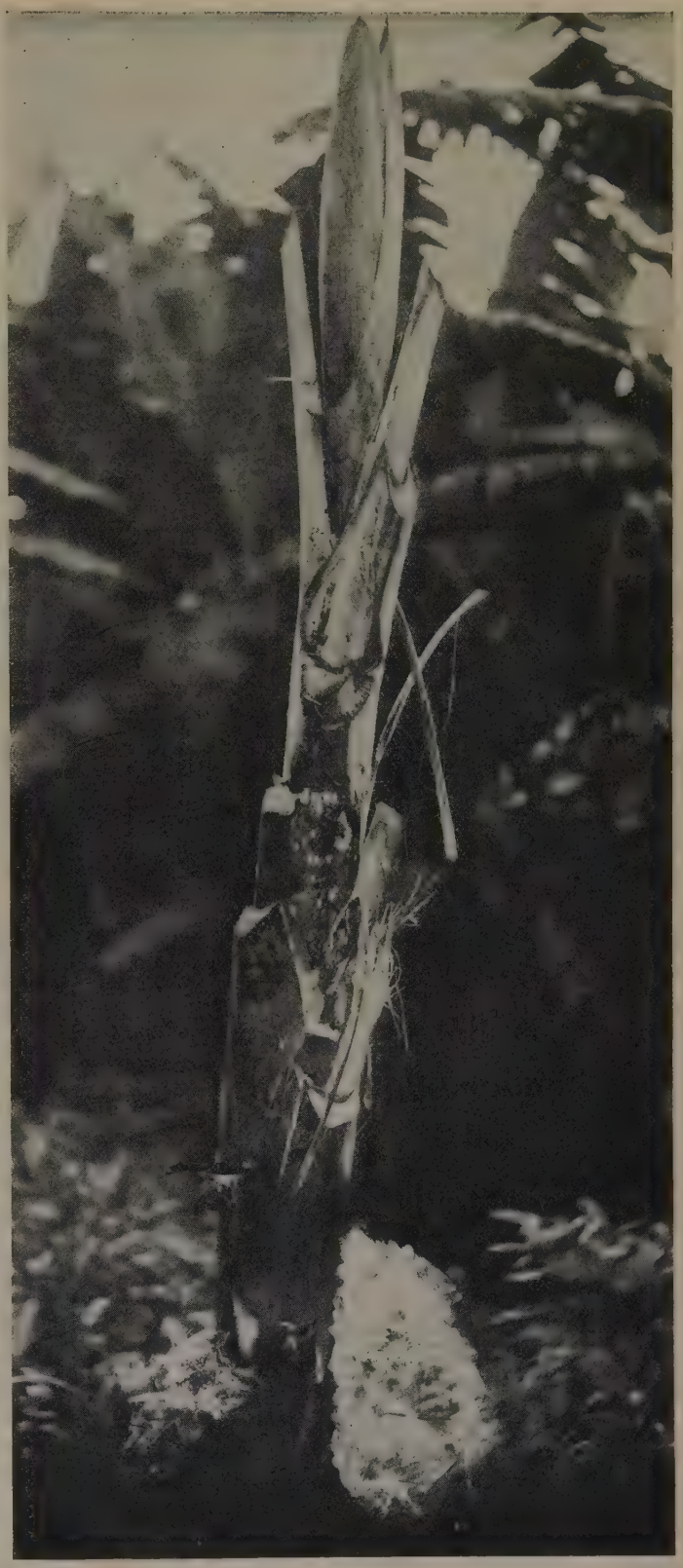
jungles has been supplanted by orderly and scientific plantation. In preparation for the greatest fruit farms in the world, much territory has been developed on a large scale. Railways, villages and sanitation works, roadways, shipping ports and lines of communication by wireless and otherwise, have been established.

The first step in the creation of the modern banana plantation is the clearing of the land and the installation of the works of improvement. The area must be provided with drainage, with means of transportation and with housing facilities for workers and their families. Hospital provision is an essential factor in a tropical country, and American enterprise has supplied this along with its other aggressive development of the industry.

The rank tropical undergrowth is cut away with the hacking strokes of the machete, and the planting takes place immediately. The completion of the clearing process follows the planting. The large trees are cut down to give freedom of growth for the banana plants. The tropical conditions make the debris an important factor in the cultivation of the banana plants, for moisture and intense heat quickly convert the smaller portions of the waste material into the rich humus produced by decay. Even the solid woody portions of the larger trees are decomposed in comparatively short time. The felling of the trees appears to do no damage to the plantings, for the banana sprouts have a way of growing through the tangled mass and around obstructing trunks and branches.

After a few weeks the area is cleaned by a cutting process to rid the trunks of the tangled branches which threaten to strangle the growing plants. This cleaning requires repetition three or four times during the growth of the plantation. At such times new planting takes place to overcome the failures of any of the original bulb-roots.

From the standpoint of the harvester, the banana is ripe when it is green. In order that it may withstand the hardships of travel, the fruit is gathered before it begins to take on the tinge of yellow. Harvesting is a delicate process, anyway. In bringing the bunch to earth from its elevated position on the plant, it is necessary to prevent bruising by too sudden descent. The harvesting is accomplished by means of a knife at the end of a long pole—somewhat like a pruning knife used for the upper limbs of our own shade and orchard trees. The first step in harvesting is to make a gash in the stem of the tree, below the bunch itself. The cut and the weight of the fruit allow it to bend, and the bunch is gradually lowered with the aid of the harvester's pole. As the bunch is taken by the man who is to bear it away the fruit stem is cut in two. The tree itself is then cut down, to rot and enrich the soil.



Courtesy United Fruit Company

BANANA PLANT AT TEN MONTHS

At the stage here shown the leaves have been cut away to show the husk-like flower bud emerging at the top.

The bearer carries the fruit to be loaded on

Courtesy United Fruit Company

WHERE THE TRAMCAR IS THE MEANS OF TRANSPORT

The railways are supplemented by a network of tramways extending into the heart of the plantation. The bullock-power is an important element in the journey to the markets of the world.

mule-back or on one of the tram-cars which travel over the network of tramlines penetrating the plantation. Transported to the "banana railway," built to handle crops and supplies, the fruit begins its journey to the sea and to the markets of the United States and the rest of the world.

The harvesting of the banana crop is not a simple work. To save waste the gathering of the crop must consider the number of ships handy for use. Then, too, the "bridge of ships" must be enough to meet the size of the output. American enterprise has provided a vast fleet of modern vessels which maintain a steady flow of bananas from the tropics to commercial America.

The industry maintains its own radio and telephone systems. The cutting depends upon the arrival of ships. In this way it is possible to carry on systematic operations, determine how many bunches are to be harvested, and arrange for their reaching the port, possibly sixty or seventy miles away, at the time the newly arrived ship is ready for loading. At the docks there is no distinction between night and day. A vessel's full cargo of as much as 75,000 bunches may be taken on in less than fifteen hours. Where there are mechanical loading machines the work is simplest, but even in the smaller ports the man-power is carefully directed and the loading process is quickly completed.

On the ships the bananas are stored in bins, for the prevention of bruises by the rolling of the ship. The bunches stand on end, bottom up, or in layers alternately standing and sidewise. Ventilation and refrigeration are both essential and the ships are built to provide these. The fruit generates heat and this must be kept down, to prevent premature ripening. In winter voyages, as the ship moves into colder climate on its northward voyage, artificial heat takes the place of refrigeration, maintaining uniform temperature. At the ports in the southern states the piers are equipped with unloading machinery, which enables quick removal of the cargo and prompt transfer to railway cars. In the northern ports the unloading is done by hand, th men forming an endless chain and passing the bunches from one to another in its journey to the dock at which the ship is tied.

Inland shipment is by banana cars, especially equipped for refrigeration and artificial heating. Track is kept of these cars by telegraph to reduce delay in unloading them at destinations. There the green fruit is placed in the ripening rooms of the jobbers, before they find their way to the ultimate

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ONE OF THE LAST STEPS IN THE JOURNEY TO MARKET

Bananas must be harvested green, and the ripening room is an important factor in bringing the fruit to the proper state of maturity. An even temperature is maintained in this room.

consumer. Banana experts insist that for flavor and food value the time to eat a banana is when the yellow skin begins to show signs of discoloration.

Those who grow and sell bananas never speak of a "bunch." They call it a "stem." Each row of bananas is a "hand" and each separate fruit is a "finger." Commercially the first grade of bananas, as to size, must be in the form of a "stem" containing nine or more hands with not less than thirteen fingers. The sizes diminish to six hands of ten fingers, or a total of not less than sixty bananas to the small bunch. The weight of a bunch of bananas ranges from fifty to seventy-five pounds, and there have been bunches containing twenty or more rows, and consisting of a total of 300 bananas.

The banana plant reproduces from the original root-stock, after the harvesting and cutting-down process. A single stock may offer numerous shoots, the least sturdy of which are pruned away and the others allowed to mature to replace trees which have been cut down. This results in continuous production over a period of many years from one planting. An interesting habit of the banana plant is to create a brown stain on the hands of a white man, as a result of contact with the juices of the plant in working amidst the tropical growth.

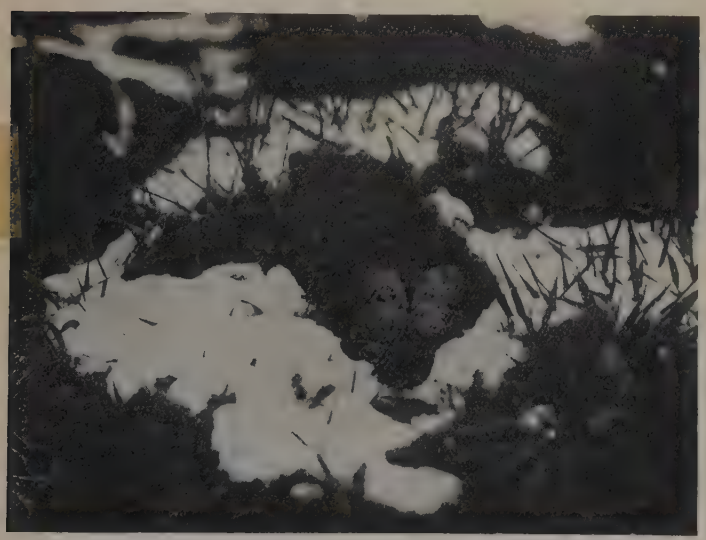
Snow Time in Nature Land

By HOWARD TAYLOR MIDDLETON
(Photographic Expert)

"IT'S snowing!" To the worker in the city office, whose overshoes and umbrella are reposing in a closet at home, this announcement is apt to be accompanied by language most inappropriate for reproduction in Nature Magazine, but to

AFTER A SLEET STORM

Take the picture so that the shadows fall across the foreground. This greatly enhances the beauty of the scene.



KILLDEER EGGS IN THE SNOW

A snowstorm in late April was responsible for this picture, which is much prized by the nature artist.

the true lover of the out-of-doors, the news is good indeed, and for more than one reason.

The minds of a great many people tenaciously hold fast to the mistaken idea that winter is an off season for pictures—that all photographic equipment should be stored away in the cedar chest along with the Palm Beach suit and the muslin gown. However, if these summer snapshooters will take just one winter hike across the ermine-cloaked countryside while the snow is newly fallen, they will agree with the writer that snow time in nature land is camera time as well.

The morning after a nocturnal snowstorm is the time to scan the bulletin boards of nature land. The white feathery floor of every field and wood

FOOTPRINTS IN THE SNOW

This shows where a hound nosed out a rabbit's trail and proceeded to follow it.

will have clearly engraved upon it autographs of wild folk, and, to those who know, every signature is as easily recognized as though it were written by the hand of man. There is no better way to learn the identity of the many creatures that haunt every country neighborhood, and which because they are largely nocturnal are rarely met, than by searching out and photographing their footprints in the snow.

Winter bird-photography is rare sport, and

owing to the fact that it can be conducted in the average dooryard, it is open to every pictorialist. All that is needed in the way of equipment is food for the birds, a camera, tripod, a bit of thread—and patience. Even those shy feathered friends who hesitate to partake of man's hospitality when the bosom of Mother Earth lies bare, are only too glad to peck at the crumbs and grain with which we bait our studio when their own dining rooms are snowbound.

That impudent and exceedingly cunning rogue, the English sparrow, a subject most difficult to photograph at other times, is now perfectly willing to exchange a portrait for a meal.

A pleasing touch of novelty may be given photographs of winter birds by so arranging the studio as to introduce an element of humor. The Café Junco, pictured in this story, was manufactured from three pieces of wood and a yellow card. One piece (the floor of the café) was nailed to the top of a second (pointed at one end for driving). Then the third piece was whittled into a rough signboard, and the yellow-lettered card pasted to it. A yellow card was used because yellow photographs much more satisfactorily than pure white. When the sign had been tacked in place in front of the café, the establishment was set up and declared open for business. Inasmuch as the restaurant had been named in honor of a dainty slate-colored migrant from the north, I naturally expected him to accept the signal honor of being the initial diner, but this was not to be. *It was the silver-tongued chanter of Christmas carols, the song sparrow, who first broke bread at the grand opening of the Café Junco.

A SONG SPARROW PATRON

Here we see him about to enter the Café Junco for a hearty midday meal.

AT THE LUNCH COUNTER

Do you realize how much this food is needed by the birds when the ground is covered with snow and when food is a scarce article?

Did you ever find a nest filled with eggs in the snow? While such an experience may be put down in your nature diary as an *event,* it is quite possible. The great-horned owl has more than once been discovered brooding beneath a white blanket in the midst of a February blizzard, and when April passes out like a lion, instead of a lamb, as she is supposed to do, the killdeer plover passes through an experience of similar nature.

At the seaside when snow flurries merge into wet ocean mists, and gulls are wheeling gray wraiths, unique flight photographs may be procured. These pictures will not be sharp and clear, it is true, but to the artist-cameraist who revels in the unusual, they hold a wealth of charm.

City dwellers, far from the picturesque land of Dan McCowan, where wild big-horn leap in play among the rocky ridges, still have their zoological

*The song sparrow sings for twelve months in the year, but more sparingly in the winter.—THE BIRDS OF NEW JERSEY.

GOOD MORNING, FOLKS

A prairie dog beholds the world from his cellar doorway on the morning after the snowstorm.

gardens and game preserves in which to stalk big game, and there is really much of interest awaiting the nature lover's camera at such places after a snowfall. It is then that all sense of confinement is lost amid the white surroundings, and a more natural and striking effect made possible than at any other time during the round of the year.

GULL IN SEA MIST

"At the seaside when snow flurries merge into wet ocean mists and gulls are wheeling gray wraiths."

In photographing snow always be very careful to give the correct exposure, in order that the resulting picture may resemble snow.

A print of a snow scene may be either a thing of beauty, full of delicate gradations of tone, or merely masses of black and white, according to the length of exposure which may have been indulged in while taking the picture.

It is best for the beginner, if he would reduce spoiled negatives to a minimum at the outset, to invest in an exposure-meter. This little instrument, which costs but a dollar or two, will be of greatest assistance in making every click a picture.

A noted photographer of my acquaintance once

SCREECH OWL IN WINTER

Screecher is here shown quietly resting in his day snoozing place deep in the snow-carpeted woods.

remarked that his small son, clad in brand-new Christmas boots, was, quite unconsciously, responsible for making a prize winner of a certain snow scene. He did this by breaking up the foreground into a pleasing roughness prior to the exposure. My friend says that from that time forth he realized no foreground in a snow landscape should be allowed to remain a blank mass of white—and I agree with him perfectly.

Another thing—so place your camera that the shadows cast by the sun can be plainly seen in the

picture, as they will add greatly to the artistic effect. To do it, the sun must be in front or to one side of the camera.

When the instrument is "shooting" directly at the sun, it is safest to shield it with the hand held above and a few inches away from the lens during exposure.

It is, of course, absolutely necessary to exclude the image of the sun from the picture. If we let the sun in, a fogged negative will surely result.

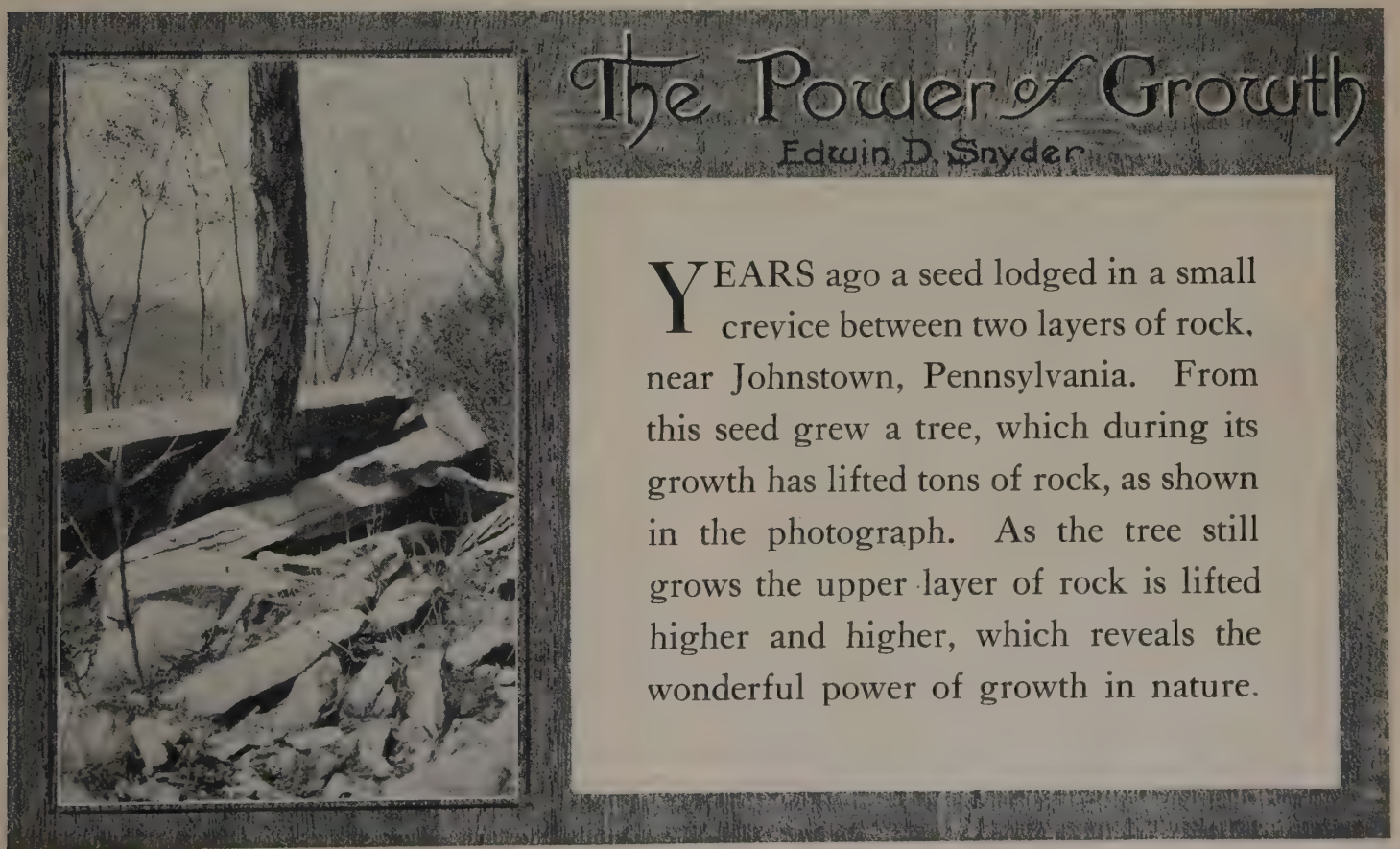
This does not apply, however when the sun is partially obscured by clouds, as that is the way moonlight effects are taken. For snow scenes in the open, expose for the highlights only, so as to procure enough contrast between highlights and shadows. For such subjects, one-fiftieth second with rapid rectilinear and anastigmat lenses, is correct.

With a single lens, use the next smaller stop than that used for summer landscapes.

These exposures are for later than two and one-half hours after sunrise, and earlier than two and one-half hours before sunset.

THE WHITE-TAIL FAMILY

Whether a picture such as this be taken in the wilderness or in the environment of captivity, a family group is always interesting.



The Power of Growth

Edwin D. Snyder

YEARS ago a seed lodged in a small crevice between two layers of rock, near Johnstown, Pennsylvania. From this seed grew a tree, which during its growth has lifted tons of rock, as shown in the photograph. As the tree still grows the upper layer of rock is lifted higher and higher, which reveals the wonderful power of growth in nature.

Evergreen Trees in Winter

By JOSEPH S. ILLICK

EVERGREEN trees have an interesting message for us at all seasons of the year. They are green in summer when other trees are green, and in winter, when many of their associates are bare of foliage, they wear a green garment that brings cheer to man and comfort to birds and other wild creatures of the forest.

Some people are of the opinion that evergreen trees carry the same crop of leaves throughout their entire life. This is not correct, for evergreen trees, as do other trees, develop successive new crops of leaves and shed them regularly, but they are not completely devoid of foliage at regular periods of each year. They differ from deciduous trees, which shed all their leaves annually, in that the leaves of evergreen trees last for a full year or more. This means that one crop of leaves can always be found on an evergreen tree and sometimes as many as five or even ten annual leaf crops are present on a tree at one time. The pines as a rule, hold their leaves only for two years, while some of the spruces carry them for as many as ten years. On a few evergreen trees as many as fifteen crops of leaves have been counted.

Fingers of ice enclose the green pine needles. The branches with the ice weighed thirteen times more than without the ice.

The group of trees generally called cone-bearers, because their fruit is a cone, are usually evergreen, while the broad-leaved trees, as a rule, shed their leaves at the end of each growing season. There are, however, a few exceptions to this general rule, for among our native cone-bearers we find the larches and the bald cypress which shed their leaves each autumn, and among our broad-leaved trees are the live oaks, some magnolias, and the Christmas holly, all of which remain green throughout their annual resting period. In speaking of evergreen trees the writer means any tree that carries a crop of leaves for a full year or more, that is, does not shed them during the resting periods, which come in winter in most regions, but may be in summer in some localities. The trees that are devoid of foliage during part of the year are generally spoken of as deciduous trees, the word "deciduous" meaning "falling off," which refers to the dropping of the leaves at the end of the growing season.

There is little contrast between the summer garb and the winter cloak of evergreen trees except that there is a touch of freshness to the new foliage that appears in spring, and the old foliage presents a rather dull and aged appearance. The eventful and contrasted life of the deciduous trees may have a strong appeal to some, but to others the constancy of evergreen trees brings melancholy joy. Oliver Wendell Holmes expressed himself so well when he wrote: "What are these pines and firs and spruces but holy hymns." They are indeed the beauty, the delight, and the glory of nature.

Evergreen trees may be recognized not only by their evergreen leaf habit, but also by the distinctive form of their trunks. In most of them the main trunk or leader continues to grow from the tip and does not divide and sub-divide into branches and branchlets as do most of the oaks and other trees with a wide-spreading habit. The branches of evergreen trees are rather small in diameter, and, as a rule, they are borne along the sides of the trunk, there taking an erect, horizontal, or drooping position. The trunk so typical of evergreen trees has been given the technical name *excurrent,*

which means "running out" or "running up," that is, it continues from the base to the tip without dividing and sub-dividing into large branches. This growth habit accounts for the narrow pyramidal crowns of most evergreen trees.

Among the principal evergreen trees are the pines, spruces, firs, hemlocks, cedars, sequoias, arbor vitaes, and junipers. In addition to these cone-bearing evergreens are such evergreens as the live oaks, found commonly in the south and along the Pacific coast, some of the magnolias, and the Christmas holly, which finds a welcome place at our firesides at Christmas time. They bring gifts of joy to us in our homes and when we are traveling

Mother trees towering with protective arms above a snow-decked family of baby pines.

about our valleys and tramping over our forested hillsides. Evergreen trees have always brought cheer and comfort to man. They are nature's most beautiful ornaments. To be deprived of their beauty would take away from us the green gems that now make our hillsides glow with glory and frame our homes with loveliness.

Evergreen trees do more than please and bring comforts to man. They are an excellent cover for game during the winter months, when many of the wild folk of the forest endure hardships and undergo privations. Walking through the woods during the winter months when the snow is deep, it is not unusual to find birds and other creatures of the forest huddled together under the shelter of a group of evergreen trees bent low with a heavy load of snow. Under this mixed canopy of leaves

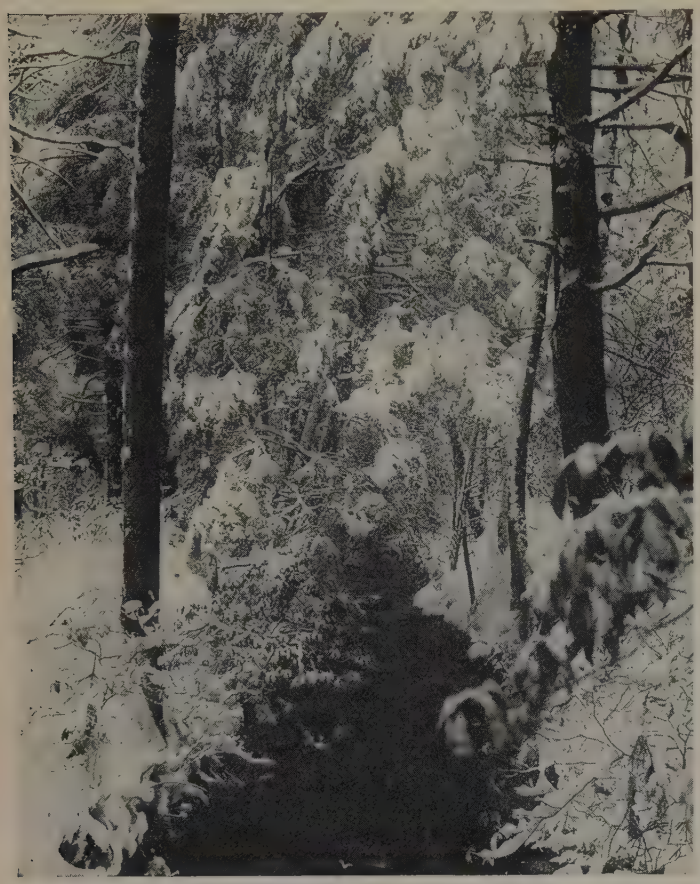
I think that I shall never see a thing more lovely than a pine tree dressed in a soft garment of pure white.

and snow they are protected from the cold wind and the deep snow. Many wild turkeys, pheasants, rabbits and deer owe their life to the shelter given to them by evergreen trees. These evergreen trees not only offer shelter to the wild folk, but also make available a food supply. All who have tramped through the woods in winter must have observed that the ground under evergreen trees is often bare, while elsewhere the snow is deep. If it were not for these sheltered places the creatures of the forest would not be able to endure the cold of winter nor could they find food during the long periods when snow covers the ground and prevents

The pitch pine with its garment of green gives cheer to the fields during the bleak winter.

them from moving about to their favorite feeding grounds.

There are no better natural wind-breaks than those formed by evergreen trees. During the winter months many a home is sheltered from the strong and bitter winds by a friendly row of evergreen trees. The early settlers of the Great Plains



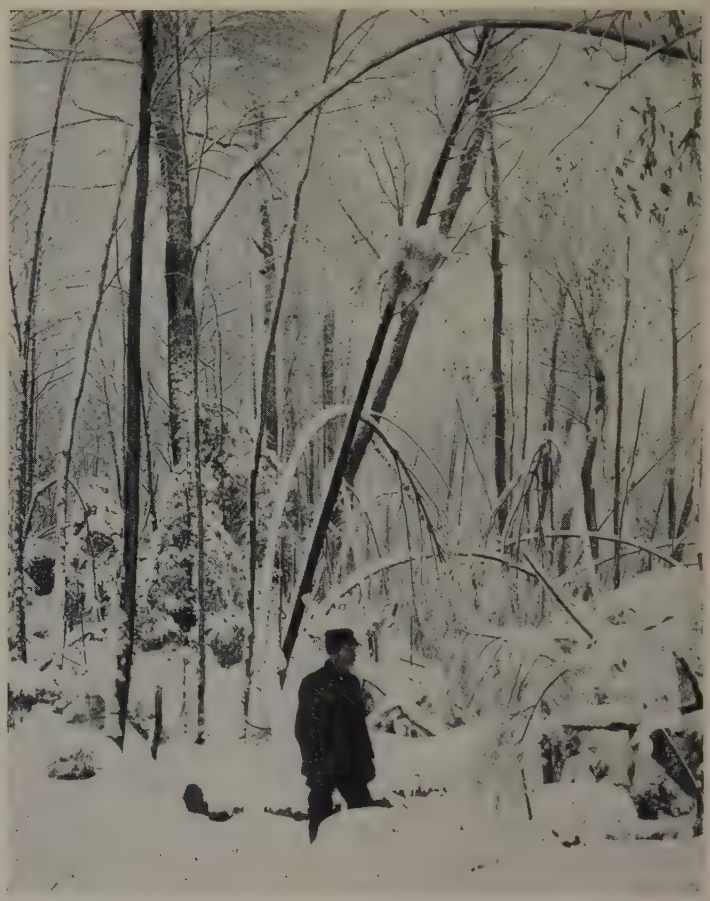
A sylvan scene of white cloaked evergreen under the sheltering foliage of which many wild folk find food and refuge.

soon learned that a wind-break of evergreen trees sheltered their homes and protected their barns and brought comfort to their cattle. Orchardists all over our country know that the shelter of evergreen trees on the windward side of their orchards protects their favorite fruit trees against the drying and killing winds.

Evergreen trees protect our highways and railroads against the damage of drifting snows. In all regions of our country evergreen trees are giving great service in helping to keep open lines of transportation that would otherwise be blockaded by masses of snow. Many of the railroad companies of the east are now planting single, and in some places double, rows of evergreen trees along their rights of way to prevent the shifting snows from being deposited in banks and drifts on the tracks.

Evergreen trees beautify the landscape and adorn the home grounds. In regions where evergreen trees are unknown, the landscape is monotonous and the makeup of the forest is less attractive than in places where evergreens are intermingled with other members of the forest household. Nature nowhere adorns the landscape so beautifully and so satisfactorily as where evergreens dot the valleys, hillsides and mountain tops. It is a beautiful picture to look at distant highlands blackened with forests of murmuring pine.

I know of no more beautiful picture that nature paints annually for us than a clump of evergreen trees veiled with a white garment of soft snow. Grown-up evergreen trees are more conspicuous than deciduous trees, yet many of them cannot be seen during the winter months when the snow is



Under the shelter of a canopy of soft snow and bending trees the wild folk of the forest find comfort and food.

deep. I am thinking of the baby evergreen trees that sleep throughout the winter under the cover and protection of the snow. Baby pine, spruce, and hemlock trees when one year old are rarely more than two inches high. When two years old they rarely exceed five inches in height. It follows that baby evergreen trees under five years of age spend most of their winters under a warm and protecting carpet of snow. During the winter months these baby trees are resting and as the snow melts in springtime they lift their tiny heads above their

cloak of winter and make ready for another season's growth. Nature has kindly provided protection for these tender little trees, for only when they become bigger and are covered with a protecting cover of bark can they battle with the severe cold and strong winds of wintry weather.

No winter scene is more lovely than that clad in evergreen trees covered with white garments of soft snow.

I know of no living plants on the face of the earth that give more permanent cheer to those who mourn than beautiful evergreen trees dotted about our final resting places. Both the living and the dead seem to love to rest beneath the quiet shade of evergreen trees. While traveling through New England a few years ago I found many cemeteries bordered by beautiful white pine trees. In these holy acres the dead rest serenely, with patches of sunlight playing on the moss-touched tombs, and a carpet of pine needles making soft the reverent tread of friendly feet. It seems as if the Creator fashioned some trees in such a way that their main function is to adorn, to make beautiful, and to give cheer and comfort.

Nature through centuries of quiet work has developed many different kinds of evergreen trees. In the deep, fertile valleys we find evergreens that deserve to be classed among the sylvan giants of the tree world. On the bleak mountain tops and on the wind-swept seacoast occur many dwarf or pygmy trees whose height growth has been retarded. For generations they have been battling with the mighty winds and other unfavorable agents. Some of these small trees have inherited features that are desirable for ornamental planting. One of the best known and most widely used of dwarf trees is the Muhgo pine. It is a pretty pygmy tree, native to the mountains of Europe. About ten years ago while traveling on snowshoes on high mountain tops of the Black Forest of Europe, I saw the tops of evergreen trees projecting above the snow. Upon examining a small sprig, I found that it was a European mountain pine, of which the Muhgo pine is the best known ornamental variety. For centuries these mountain pine trees have been struggling for an existence on these high mountain tops. They have remained small for so many generations that they have forgotten how to grow big. These small trees are not only suitable to beautify home grounds and public places, but they adorn most beautifully the mountain tops that would otherwise be bare and bleak. The service that these small evergreen

A city of hope among white pine trees where human beings in depleted health find consolation, comfort and renewed strength.

Balsam fir, one of nature's green gems and a great favorite among our numerous evergreens.

trees give to man by beautifying and protecting the mountain slopes, are as great as the gifts given to us by sylvan giants that grow in the protected valleys below.

In temperate regions evergreen trees are found everywhere from the shores of the ocean up to the timber line on high mountains. They beautify the banks of streams, clothe the steep mountain slopes, adorn our rural landscape, beautify our parks, and give an expression of loveliness to our homes. They are truly our friends, for they bring us messages of cheer and gifts of comfort. Let us plant and protect our evergreen friends. To plant them is an act of faith, and to protect them is an act of kindness.

More than fifty million evergreen trees have been planted in Pennsylvania during the last twenty-five years.

The Letoptilus Marabou

By DOCIA WEAVER HADLEY

I WONDER if it would enhance or dampen the enthusiasm of the woman who possesses a costly and beautiful marabou collarette or boa, if she knew that those lovely feathers came from under the wings of the most repulsive scavengers of the stork family.

In the native villages of Africa they are reverenced as sacred—in Arabic, marabou means saint—so they are quite tame and are allowed to stalk around the native huts unmolested.

Though obnoxious, they are really a blessing, as they devour great quantities of filth and troublesome insects that would surely be a menace to the occupants of the villages.

The ugly adjutant-bird of India is of the same family and its feathers are put to the same use.

The Bambara, Mohammedans and Arabs of West Africa especially hold the birds as sacred.

These birds generally are of a quiet disposition, although sometimes they grow vicious with age.

New Years Greetings

ANNA BOTSFORD COMSTOCK

THE New Year of 1924 marks an epoch in the realm of nature lore, for it sees united the Nature Magazine and the Nature Study Review, the two to work together for the good of their common cause. These publications have occupied different fields: the Nature Magazine has for its object the cultivation of an interest in the life of the fields and forests, which will lead the public at large into many of nature's hidden by-paths as well as along her oft-trodden highways. The Nature Study Review was founded eighteen years ago for the purpose which it has consistently followed of inducing the children, through the best methods of teaching, to observe and learn for themselves the facts of the natural world, in the belief that such a beginning will, through its own impetus, prolong this habit for rest and recreation in the future years of their lives.

ANNA BOTSFORD COMSTOCK

The Nature Study Review, as a section of the Nature Magazine, hopes to continue its work in a larger way for the teachers and children of America. The joys and sorrows, the enthusiasms and prejudices, of childhood, continue to be factors in the life of the adult. Let each of us think of the birds, flowers, trees, and animals that we loved and cared for when we were children and we find that these are the ones that we love best still. It is equally true that those plants and creatures which we disliked, feared, or hated in our first years, remain always disagreeable to us. The former is as fortunate an experience as the latter is unfortunate and unnecessary; for often the wider knowledge which we have tried to disseminate would have changed childhood bugbears into happy interests. Because of these strong, lifelong impressions received in childhood, it is all important to make the child intelligent and imbued with the spirit of the investigator in all his contacts with nature.

Because of these considerations, it is necessary that the teaching of the young go forward, hand in hand, with a wider knowledge of this remarkably interesting planet which is, fortunately, our present abiding place. Thus the Nature Study Review, joined with the efforts of the Federation of Women's Clubs, will, through the schools, make the child ready to receive and use the wide range of information concerning the "birds, beasts, fish, trees, plants, and other living, breathing evidences of the Creator's handiwork," which is presented in the Nature Magazine, illustrated so fully that it falls into the approved lines of visual education, and thus cannot fail to be an inspiration alike to the pupil and the teacher. To all nature lovers, this is indeed a Happy New Year.

What Every Mother Wants For Her Child

By MRS. JOHN DICKINSON SHERMAN

Department of Applied Education, General Federation of Women's Clubs

MOTHERS are rapidly awakening to the value of natural science and nature teaching for their boys and girls. They want the minds of their children opened to the voices of nature—to have their senses so trained and adjusted that all the world will be alive to them.

Nature study has a necessary place in child training that nothing else can fill. Mathematics,

WASHINGTON, D. C., SCHOOL CHILDREN POSING AS FLOWERS

A nature festival, written and presented by Mrs. Elizabeth K. Peeples, nature study instructor for the Washington, D. C., Public Schools, depicted Forest Conservation, Star Study and School Gardens so graphically that an audience which overcrowded the big school building declared it the most remarkable production ever given by school children.

language, history, and geography each serve invaluable cultural purposes, but these alone will not produce the efficient mind. These studies are learned from books; nature study puts it up to the child. He must discover his facts for himself in the flower that grows in the garden, the bird he follows from tree to tree, the pebble with the curious streaks which he finds in the land. His quest for pretty specimens, and then for origins and functions, develops an independence of thought and action and a self-born interest which books do not inspire. His natural curiosity is developed and trained. He wants to know what causes this, how that grows, why one bird lives in rock ledges and another in swaying branches. He learns to investigate, to reason from observed facts, and the wholesome imagination which he develops will be one of his greatest educational assets.

And while he is making friends with Mother Earth and she reveals her treasures to him he will have developed physical health, strength of character, understanding and human sympathy—all vital attributes which every mother wants her child to possess.

Furthermore, the study of nature as it is related to the playtime of children cannot be overestimated. The play life of the child is really more important than his school life. It is during childhood that character is in the making. Charactor formed in childhood may be remade, modified and improved in later years, but the task is difficult. In childhood the use of playtime is often

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Nature Study the Key to Knowledge

By THORNTON W. BURGESS

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(Photographs by L. W. Brownell)

REPEATEDLY have I heard nature study called a fad. I have encountered school teachers who could see no place for it in the school curriculum. They taught it as best they could, but always under protest. I have met parents who appeared to consider nature work as taught in the lower grades one of the frills of the modern educational system. They had nothing of this kind in their youth, and directly or indirectly charged that the time devoted to this line of work by their children was sheer waste.

There are none so blind as those who will not see.

BLUEBIRD AT NESTING HOLE

These birds build in cavities of trees and raise several broods during the course of a year.

Nature study is a basic element in education. It is not a fad. It is not one of the so-called frills. It is fundamental. It should be given a far more important place in school work than it now has. It should be a primary subject from the kindergarten straight through the high school. It is the golden key to the vast storehouse of knowledge.

In this materialistic age we are prone to regard as useless those things which do not contribute directly to the attainment of the false standard of success which is gauged by wealth. Those things which appear to have no direct bearing on the attainment of this end too often are regarded as useless. The

YELLOW WARBLER AND HER HUNGRY FAMILY

The nest is made of fine grasses and vegetable fibers which are finely woven together.

finer things of life are crowded aside to await the sometime leisure which material success may bring. When that time comes, if it does come, all too often it is too late.

Nature was the pioneer teacher. She still is the greatest of all teachers. Man was little above the beasts of the field until he became observant of his surroundings, and from these observations endeavored to better his own condition. This was nature study pure and simple, and the beginning of education. Every great advance which the human race has made, from the discovery that fire could be made man's servant to the development of radio, has been through increased understanding of nature's laws. Art began in the first crude attempt of man to reproduce on the walls of his cave images of the things he saw. Music's birth was in his first

awakening to a sense of melody in the songs of birds, the sound of running waters, and the whispering of wind-stirred leaves. Poetry came into existence when he first sought to express his awakening sense of the beauty surrounding him.

Interest in living things is inherent, and interest is the primary essential in education. For this reason, if for no other, nature study should begin

WOOD RAT

These timid little folk usually wait until dark before taking the chance involved in leaving their homes.

in the kindergarten. No fairy tale is so wonderful or so fascinating as the springing forth of a living plant from a tiny seed planted in the earth, and its subsequent growth into a sturdy plant developing flowers and ultimately the seeds which shall perpetuate the miracle. No magic can compare with watching a caterpillar spin its cocoon and later emerge an exquisite moth.

There is a psychology in nature study for children which many teachers fail to understand, and which makes it the most perfect vehicle for conveying to the child mind, in a way that is at once understood, practically all those things which it is desirable to teach. Intuitively every child knows that it is superior to any lower form of animal life. He will not admit even to himself that any animal or bird has a greater degree of wisdom than himself. Would you teach thrift? Give the child the opportunity to observe Happy Jack Squirrel storing supplies in time of plenty for the period when there is a shortage of food, or tell him a story of how Happy Jack does it. Would you teach the meaning of love? The birds in the nesting season are living examples which cannot be misunderstood.

Whitefoot, the wood mouse, and Timmy, the flying squirrel, come forth after dark because it is safer for them then. Stories of these timid little wood folk have cured children of all fear of the dark. In their minds there could no longer be entertained fear when these little people found only friendliness in the hours of darkness.

A certain small boy made a great fuss over having a window raised in his room at night during cold weather. He read some stories of how Jerry Muskrat makes provision for the entrance of fresh air into his house of rushes, and from that time on insisted that his window be left open. He would not admit that Jerry Muskrat was wiser than he.

Paddy, the beaver, is a living example of the joy of constructive work and cooperation. The bees in their hive illustrate without comment how the individual cannot live for himself alone. Love and mercy spring forth spontaneously with the understanding of the fact that the lives of lesser creatures closely parallel the child's own life. Old Mr. Toad with his wonderful eyes, his sweet song of the spring and his tireless industry in the destruction of harmful worms and insects, teaches how beauty and usefulness may be attributes of the homely and seemingly ugly.

MUSKRAT OR MUSQUASH

These animals live in burrows or else in houses made of reeds and clay along small streams and in swampy places.

The closely wrapped buds on the trees in winter, a living pledge of the joyous return of spring, remove all thoughts of sadness and demonstrate that life is eternal. The chickadee coming to the window shelf, even feeding from the hand, proves that fear cannot exist where there is an instinctive feeling of trust and confidence.

The mystery of life becomes clear to even the youngest child as he witnesses the transference of the pollen from the anthers to the stigma of a

flower, and it is explained how the two elements unite to form one in the ovary, and there grow into the seed, which in turn develops into another living plant of the same kind.

These few examples illustrate how nature study can be made and should be made a primary instead of a secondary study in the education of the child. The imagination cannot fail to be stimulated, and given interest and imagination, the doors of knowledge swing open. Without imagination there can be no progress. Vision is but imagination governed by logic.

The failure to give nature study its proper place in education in the past is largely responsible for the vanishing wild life and forests of today. The birthright of the nation has been wantonly wasted and is still being so wasted with result, which, to those who thoroughly understand conditions as they are, is nothing less than appalling. We are told that the age of large mammals of the world is drawing to a close. A generation or two hence

DOUBLE SWARM OF HONEY BEES

The wisdom and the industry of this insect have won it the admiration of mankind.

there will be no large wild animals left, unless very radical measures are taken at once to save the species remaining. Like conditions prevail in regard to many of the smaller animals. Several species of birds have become extinct within the memory of men now living. Other birds are on the verge of extinction. Many species of wild flowers are facing the same fate. We of today are robbing our children's children of their birthright.

What are we going to do about it? There is but one thing that can be done. See to it that the next generation and succeeding generations are nature lovers. The true nature lover is never destructive. Love for the living thing, the bird, the animal, the

BEES WORKING ON COMB (POINTING TO QUEEN BEE)

The builders who do the active work of building the new cells for depositing the honey.

tree, the flower, prevents even the impulse to destroy. Country boys have written me that they have given up trapping. No one asked them to. Trapping meant an outdoor activity, which is fascinating to the average country boy. It also meant money. But voluntarily they gave it up. Through reading they had become interested in the little fur bearers. They had learned to appreciate the fact that these little animals live lives which closely parallel their own. The sense of justice, inherent in every boy, recognized the rights of these little creatures to live their lives as best they could. The boys recognized the difficulties which at best beset these little wild people daily in their efforts to survive. They no longer desired to add to these difficulties. They had become protectors instead of destroyers.

The boy who in early life learns to understand what a wonderful thing a living tree is, will never thoughtlessly mutilate it. The girl who is given a

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Newt--The Story of a Salamander

By THEODOSIA HADLEY

Teacher of Nature Study, State Teachers College, Kalamazoo, Michigan

RETURNING from lunch one day this spring, I found a candy box on my laboratory table. Holes were punched in the top of the box and the lid was carefully tied on with a string. This box contained a prize indeed, a baby red-spotted newt lying on some dry dirt and looking very unhappy. I put him in a vivarium with moss and moist earth in the bottom. Across one corner of the vivarium I propped a flower-pot saucer which made a darkened secluded corner for him. He crawled under the saucer in a dejected manner, curled his tail around him and laid down his head.

I filled a small dish with water, and as I was sinking the dish into the mud to make the top level with the moss, out shot Newt from behind the flower-pot saucer and into the water dish. He was so quick that I could not tell whether he jumped or whether he ran so fast that he looked as if he jumped. I have never heard of newts jumping, but the way he splashed into the middle of the dish gave the impression that Newt was a good diver.

He stuck his head into the water and opened his mouth several times as if he were drinking. Then he pulled his head out and raised and lowered himself on his legs so that the water would wash over his back. After making little ripples over his back for a while he pulled his body out of the dish, but his entire tail remained submerged. He slashed his tail about in the water for a while and then very slowly and sedately, examining everything with his bead-like eyes as he went, he walked back under the flower-pot saucer.

A BIG COUSIN OF THE NEWT

After such a thorough bath, which left the water a little muddy, I thought Newt would prefer fresh water for drinking purposes. I never saw Newt give himself a bath or take a drink after the first day, but the water was always muddy in the morning, so I knew that he bathed at night.

As I was putting the fresh water in the dish the pupils began to arrive for class. They were very much interested in Newt. Some thought that he was a little alligator; one kept her distance from the vivarium, saying that she knew he was a snake.

I explained that he was related to the frogs and toads and was no more dangerous than a tadpole. That reassured the timid ones and they began to examine Newt minutely. They noticed his queer little round, bead-like eyes with no eyelids, the funny oblong holes for his nose and his immense mouth, which when opened was the entire length of his head, his little paddle-like feet, and short crooked legs.

Then I explained what had happened when I put in the dish of water. How did he know it was there? He couldn't see it because he was behind the flower-pot saucer. Did he smell the water or does his moisture-loving skin have some finely adjusted organ for detecting humidity? Perhaps some one who knows newts more intimately than we do will enlighten us on these points.

The next point noticed was that his sides were sunken; he looked hungry. Then we had a perplexing problem: what do newts eat? One thoughtful pupil suggested that since he was related to frogs he might eat flies. The entire class rushed to the windows to catch a fly, and soon returned to Newt. Some had dead and some had living flies. I suggested that one wing be pulled off the live flies to give Newt a chance to catch them. He paid no attention to a large dead fly that was laid near the water dish, but the first live fly that was offered to him he seemed to hear the instant it was dropped into the vivarium. He crawled from behind the flower-pot saucer and very stealthily approached the insect. He watched it carefully for a moment and then—so quickly that we did not see how he did it—the fly was gobbled up. Food of the other laboratory pets was offered to him. Some of the mallard duck's lettuce was put in the vivarium. Then the pupils tried some of the rabbit's carrot and cabbage and some of the guinea pig's oats and dandelions—all to no avail.

As the supply of flies was quickly exhausted and Newt's sides were still sunken with fasting, the next question was—what else besides flies will frogs eat? Someone suggested that he might like earthworms. So the boys were supplied with spades and the girls with trowels and the remainder of the class period was spent in studying the habits and structure of earthworms, as we collected them for

Newt's menu. After class I offered Newt a small earthworm. His hearing must be very acute. I had just put the worm on the moss when Newt began coming out from behind the flower-pot saucer. He watched it very keenly for awhile. Then very slowly he walked around to the head end of the worm; with a wide flap of his jaws and a quick jerk of his head he had half of the earthworm swallowed; another head jerk and the worm disappeared.

The older pupils soon lost interest in Newt, and he wasn't getting enough to eat, so I took him over to the children of the fourth grade. They immediately adopted Newt as their most cherished possession. They found out what he liked to eat and he became so tame that he would eat flies while the children's hands were still in the vivarium.

SCHOOL CHILDREN STUDYING THE NEWT

One day while I was lecturing, a little tow-head appeared at the door. He was full of excitement over something, so I went to see what it was. "We have found out why Newt always goes to one end of the fish-worm when he starts to eat it. If you pull the fish-worm one way he has prickers on his stomach. If you pull him the other way you can't feel the prickers and Newt swallows the end so the prickers won't scratch his throat."

I made it my business to go into the room the next day and found the children gathered around a basin and so engrossed that they did not see me. My first thought was that they were giving Newt a bath. They had a large basin of water with a ruler lying in it, and Newt was in the water crawling up the ruler. A little girl explained to me that since Newt was a cousin to the frogs they thought perhaps he might prefer to live in water and they were trying the experiment. But Newt didn't like it. He was getting out of the water as fast as his fat body would let him. I hadn't seen Newt for a week and he was immense compared to the lean creature that I had given to the children.

Newt had been kept waiting for his breakfast until I arrived. There was a big "night-crawler" in a dish beside the vivarium. I asked if they could tell me beforehand which end Newt would swallow first. They showed me the head end and explained that you couldn't feel the prickers if you pulled the fish-worm that way. Then Newt took his breakfast accordingly, in a perfectly satisfactory manner for all concerned.

Vacation time was approaching. There was a grave problem to be decided. What was to happen to Newt? The teacher suggested that he be taken to a nice wet spot in the woods and given his freedom. But the children were almost in tears at the thought of losing their pet and all sorts of objections were offered.

Finally one boy said, "Let's give him to George." George was one of their schoolmates who had to stay in bed all day until he grew stronger. George's mother was visited by a committee of two boys and one girl, selected by the children. She said that George could have Newt and George couldn't wait to see him.

The children took Newt over to George's house and explained to him how to take care of him, and George keeps him at the side of his bed day and night. He pays his brothers for supplying Newt with food by letting them feed him once in awhile.

George thinks that he will be strong enough to go back to school in September and he is going to take Newt with him.

Why Teach Nature Study?

By DR. ELLIOT R. DOWNING

SCIENCE has made three great contributions to the welfare of mankind. It has put at our disposal a tremendous mass of new knowledge that is at the base of our improved skills. It has given us a new appreciation of the commonplace things about us. It has taught us the value of the scientific method of thinking, and of the scientific attitude of mind. These three things that science has done for the race, science teaching should, as far as possible, do for the individual child.

We should try to impart to the child as much of the scientific knowledge that is now available as will enable him to live more healthfully, be a better citizen, use his spare time more wisely. In a word, we should give him that knowledge that is socially worth while to him as a child.

We should open his eyes to the significance of commonplace things. The average child is not going to travel widely—his life is bound to be rather monotonous, the daily tasks will be incessantly repeated. If we can give him some appreciation of the wonders of the night sky, of the marvels of flowers and trees, birds and insects, rocks, minerals and the forces that are at work all around him, he will realize in a measure that the commonplace things are very wonderful. He will have at his disposal a constant source of enjoyment and a means of increased culture.

The science teacher can and should train the child in the scientific method of thinking, that is, of thinking to correct conclusion on the basis of observed fact. Possibly nowhere else in the field of education is it as easy to do this as it is in science instruction. Everywhere about the child are problems in which he is interested in the field of science. He can make his own observations, his own experiments, and on the basis of the facts can reach his own conclusions. Moreover, science material is concrete material, and the child reasons scientifically quite as well as the adult when his problems are problems in the concrete and not in the abstract. It is important to learn how to think scientifically, for there are many, many problems in life to be solved; and a safe solution is only achieved when one thinks them through in this scientific way. Democracy is only safe when its citizens are capable of reasoning out its many problems to wise conclusions. Now training in thinking is not confined to science instruction. The race has always solved its problems by thinking in what we term the scientific way if it has thought through them at all, but science material does give a very exceptional opportunity for training in this process of thinking from the early steps in observation through experiment and hypothesis to the final solution. The application of science teaching is well worth while from every viewpoint and merits all the encouragement that may be given it.

What Every Mother Wants For Her Child

(Continued from page 46)

the factor which determines the whole course of the child's life. This is the time when teachers and parents have a wonderful opportunity. The interest in the world of nature and science that is aroused in the school-room can be fostered during playtime hours. If we can solve the playtime problem of the children of the land, we will have gone a long way toward solving many of the problems that today confront the people of every community.

Natural science and nature will be a recognized standard subject in the elementary grades when parents demand it for their children. The sooner this is done the sooner will the education of the nation's future citizens be built upon a solid foundation of the most desirable type.

Natural Science and Nature Study in the Schools

The following is the course of nature study advised by the Department of Applied Education of the General Federation of Women's Clubs, for the Kindergarten and for Grade One.

It can readily be adopted by a mother as a course in nature study for her children, or can be made the basis for study by any lover of nature.

Kindergarten

Gardens

Fall. Learn to **recognize** garden flowers and vegetables that are growing in school and home garden: Asparagus, beans, beets, cabbage, carrots, cauliflower, chard, corn, cucumber, egg-plant, lettuce, onions, parsnip, peas, pumpkin, radish, squash, tomato, turnip; alyssum, aster, candytuft, cosmos, dahlia, daisy, forget-me-not, geranium, gladiolus, hollyhock, larkspur, marigold, mignonette, nasturtium, pansy, petunia, phlox, salvia, sunflower, sweet William.

Bring in **decorative** garden material.

Winter. Grow paper white narcissus in water.

Spring. Plant lettuce, radishes; morning glory, dwarf nasturtium, pot marigold.

Pets and Domestic Animals

Maintain an aquarium stocked with **goldfish** and water plants, such as Caboma, milfoil, etc., in the room.

Have a cage of **canaries** and one of finches in room for children to watch and help care for. Let them observe their habits and tell the teacher what they see.

Toys and Home Appliances

Make and use paper **windmills.** Make them out of colored paper, both the four pointed and the eight pointed, and use them for school room decoration as well as for instructive toys.

Correlated Materials

Decoration of room with **autumn leaves,** wild flowers, etc. String **joint grass, rose hips, haws,** etc., for decoration.

Make a **weather chart** as part of the school room decoration. Divide a sheet of brightly colored paper into enough squares for the days of the month and paste in each an appropriate symbol of the weather.

Grade One

Gardens

Clean up garden plot.

Plant bed of **narcissus.**

Set **daffodils** in pots in trench to bring in later for winter bloom.

Transplant **dandelions** to window boxes to furnish blooms during winter.

Bring in pots of **daffodils** from the trenches and rear for winter blossoms.

Bring **dandelion** plants in the window boxes into blossom.

Plant and rear dwarf **nasturtium** in some of the window boxes.

Plant easily grown **annuals** in first grade plot (no individual gardens).

Beans and peas (fruit and seed used).

Carrots and beets (root used).

Swiss chard (leaf used). Pumpkin.

Ten weeks' stock, verbenas, sunflower, wild cucumber.

Toys and Home Appliances

Let children use **swing** to feel the force of **gravity.** Talk of it, of falling ball, of tumbling down, etc. Let them use **teeter** to get idea of balance. Try balancing a light and heavy child on the teeter and repeat so all may have the experience. How do they make the teeter go up, thus overcoming gravity at one end?

Make a **tumblejack** out of cornstalk with a lead ball or marble glued in the base. Then put on arms and dress the doll in tissue paper. The head and hat may be carved out of the cornstalk. Why does the doll insist on standing upright even when tipped over?

Make a pair of scales out of wood for base and beam and baking powder can covers for scale pans. Make weights out of bags of shot or pieces of lead, getting them correct by comparing with known weights. Let children use weights and scales as they play store. This may be a class project, children helping wherever possible. Let them have experience in balancing scales and in weighing objects. Let them guess the weight of small objects and then see how nearly right the guess was.

Pets and Domestic Animals

Finches. First grade will have care of the finches, ring doves and pigeons. They will take one sort for special attention each quarter. If there are several first grade rooms the cage of finches may go to one in the fall, another in the winter and another in the spring. The order in which these animals are studied is not important. Learn to care for the birds and to know their habits. They will likely nest and rear their young in the cages.

Ring Doves. Learn to care for these birds and watch their habits.

Pigeons. In addition to caring for the birds and watching their habits, the chief items of their structure may be observed.

Correlated Materials

Have a nutting party.

Know **oaks, hickories, walnut, beech.** Of the **fruit trees,** know apple, pear, cherry, plum.

Know the common **evergreens,** including the balsam and spruce, used as Christmas trees.

Collect tree leaves, dry them and mount them for room decorations.

Changing **length** of **day** and **night.**

Position of **sun.**

Moon's phases and relation to sun.

Common **constellations** about pole: big and little bears, Auriga, Cassiopaea, Cephas, Andromeda, Perseus, Draco, Cygnus, Lyra, and the **legends** connected with them.

Common **spring flowers:** Blood-root, blue-eyed grass, buttercup, clover alsike, red and white, white sweet clover, dandelion, dog-tooth violet, Dutchman's breeches, geranium, hepatica, lupine, mandrake, oxalis, phlox, shooting star, Solomon's seal, spring beauty, spring cress, sweet Cicely, star grass, toothwort, trillium, violets.

Where **seeds** come from. **May baskets.**

Burning Former Plant Life

(Continued from page 10)

domestic use. Anthracite and bituminous coal, in their various grades, constitute the bulk of the domestic and industrial coal. Lignite, however, is listed among the American coal resources. It does, in fact, comprise about one-third of this supply. This is an impure coal generally known in Europe as "brown coal." Compared with bituminous coal its heating value is low, and it burns with much smoke and often contains a high percentage of sulphur, but in a country less richly endowed with coal of high quality than is the United States, it would be the basis of a great industry. An oven has been invented for the conversion of lignite into a fuel with heating properties comparable to anthracite, thus promising a valuable reserve in this woodlike "near coal."

Substitutes for anthracite during times of scarcity and high price interest the harassed householder. Coke is one of the most popular, not soiling window curtains and white wainscoating as do some varieties of soft coal. It is made by the distillation of bituminous coal into gas, leaving a porous and bulky fuel that burns well when ignited. In connection with the stringency in the northeastern states, considerable attention has been given to the possibilities of coke as a substitute fuel, and its use could be greatly extended should the increasing price of anthracite invite competition.

Briquettes made from pressing together coal screenings are used in some sections. The largest difficulty has been in getting an adequate binder, but these little egg-like pieces of "canned coal," when properly made, are found to have a heat value equal to anthracite coal. It is a great pity that oil is being so extensively used for steam purposes as the oil deposits of this country are very limited, probably, as far as is known today, having a life of considerably less than a generation. Prodigality has marked the exploitation of the oil deposits even more than coal, and they can no more renew themselves than can coal. Therefore, the use of oil for fuel in view of the almost unlimited amount of bituminous and lignite coal available is greatly to be depreciated. Gas and electricity represent too expensive substitutes for heating, and wood bore the brunt of that task to a point where our forest resources cannot be expected to do more.

Courtesy United States Bureau of Mines

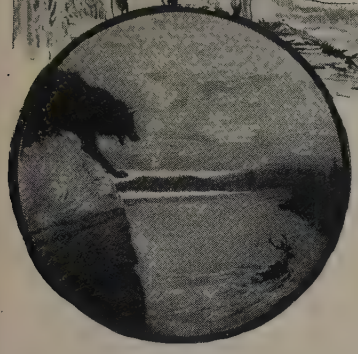
SOFT COAL BEING PREPARED FOR DISTRIBUTION

This shows how the coal is run from the mine to the tipple and is loaded into larger railroad cars and then hauled to various parts of the country.

Water-power or "white coal" gives promise of relieving our railroads from the burden of transporting coal to some extent. The super-power project advocated for the Atlantic seaboard, stretching a network of wires for the transmission of high voltage current from plants at mine heads where power is generated without the waste of transportation, promises additional relief —and saving.

In any event, we have coal mines representing a physical value and investment of more than two billions of dollars. They constitute a vital and fundamental industry. They produce an essential of our civilized life and economic present and future. They have been abused in various ways, but these abuses can be largely remedied. Nature, when she stored away these vast resources millions of years ago, left them for man to command and solve the problems they create. Man is capable of doing it.

From the Great White Way *to the* Great White Spaces



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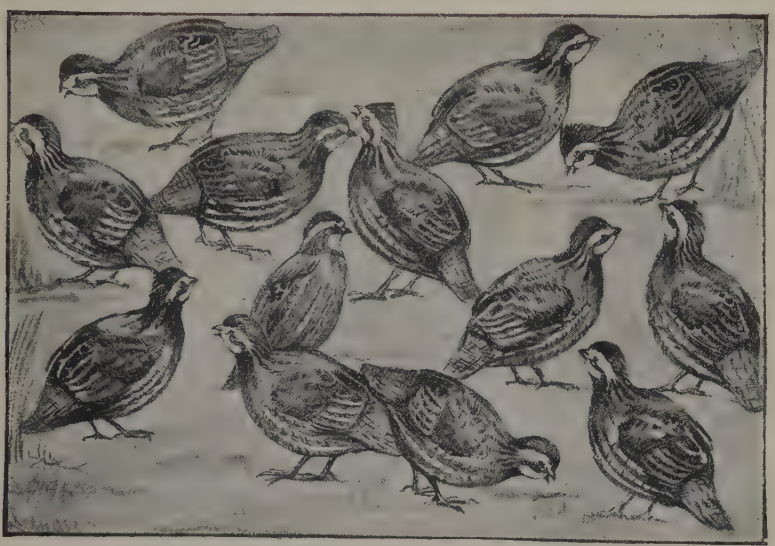
Eight of these big birds (and eight brant) per day, for three or three and one-half months. Any man who will kill in the United States eight of these birds as one day's bag, even "according to law," is not doing the fair thing.



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Average thirteen per day, for forty-one days. This lovely bird, the great friend of the farmer and cotton grower, is yet being wickedly killed in twenty-eight states.

DECREASING OUR SQUIRRELS

The common daily bag limit on gray (and other) squirrels is eight per day, but sometimes as high as fifteen are shot

THE ZERO HOUR FOR AMERICAN GAME

BY WILLIAM T. HORNADAY

Director New York Zoological Park

If the American People desire or intend to save their game on a continuing basis, they must go over the top now!

Every vanishing species will, unless checked, finally reach a point at which its fate hangs on the issue of immediate and drastic salvage.

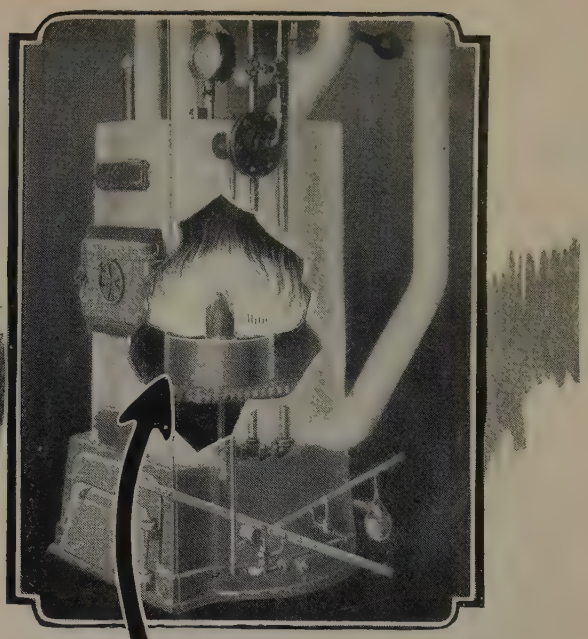
As examples of the species of American game, great and small, that now are steadily and persistently declining, I will cite the following:

The mountain sheep and goat, now to be hunted in two states only; the moose of the United States and southern Canada; the elk of Wyoming, Idaho, Montana and Washington; the prong-horned antelope, everywhere save in four protected spots; the mule deer, everywhere save on the Kaibab Plateau; the California mule deer; the grizzly bear of the United States generally; the gray squirrel in a number of states, Indiana for one; the wild turkey of all states wherein not extinct; the woodcock, in many states either absent or very scarce; the pinnated grouse, extinct over three-quarters of its former range; the quail, shot to pieces in twenty states hunting stopped; the ruffed grouse, now up, now down, but going out; and so forth and so on.

If the people of the United States lazily and wickedly permit all the game of the nation save rabbits to be exterminated, then will they richly deserve a gameless, lifeless, insect-ridden, devastated and eroded continent; and when they get it, it will serve them right.

The Permanent Wild Life Protection Fund and its leaders are determined to give the American people **one good chance** to save their game if they really wish to do it, and have the sand to go over the top to make good. The 50 per cent game salvage bill which will be introduced in each and every one of our forty-eight legislatures will do the trick—if enacted into law and reasonably enforced. But no haggling over petty details can get anywhere, save down and out. People must not demand county, or club, or individual exceptions. The reform must be sweeping and general if it is to accomplish results of great and lasting benefit.

The men and women who know how to promote good legislation must show those who do not. The task is simple enough. It is proposed to furnish a standard game bill, carefully adapted to the needs of each state case; and then it will be up to the people of the various states to see that those bills are **passed, as introduced.** In this struggle, the mothers and fathers of our American boys have got to take part, or prove recreant to the parental trusts that Nature has put into their hands. No good citizen can sit or stand idly by and see our priceless national wild life assets annihilated. All persons who wish campaign facts and literature are invited to write for it to Dr. W. Reid Blair, New York State Leader, New York Zoological Park.



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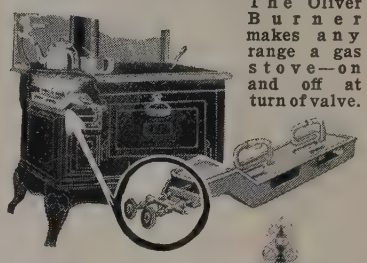

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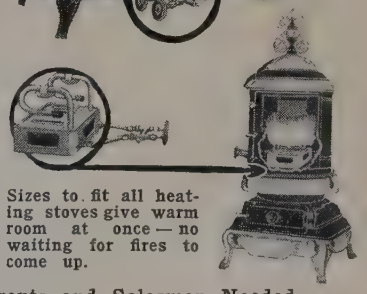

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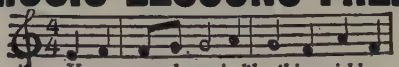

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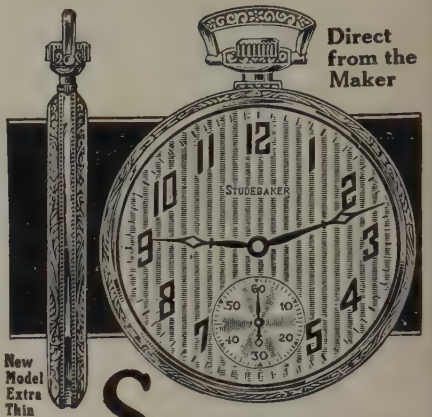

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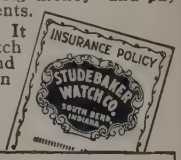

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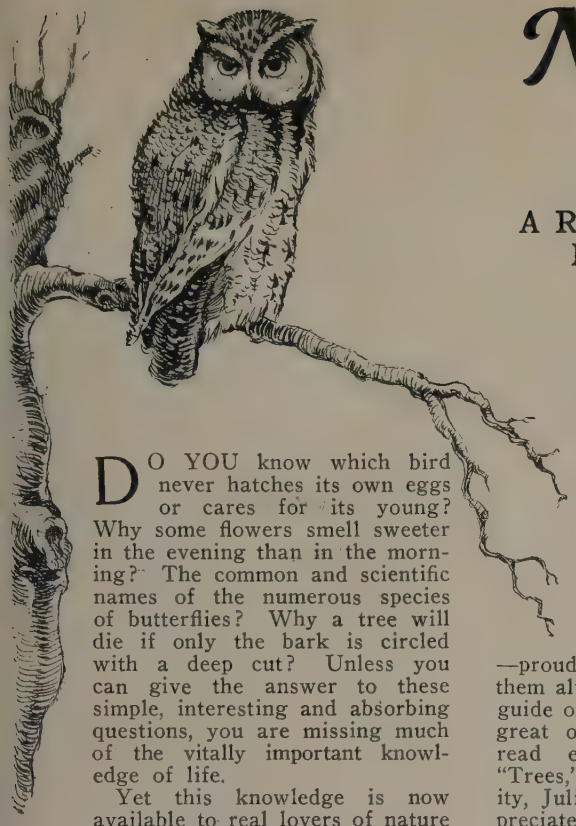

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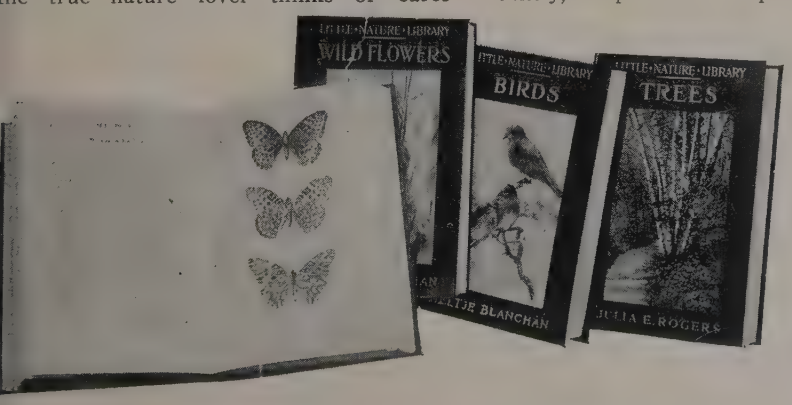

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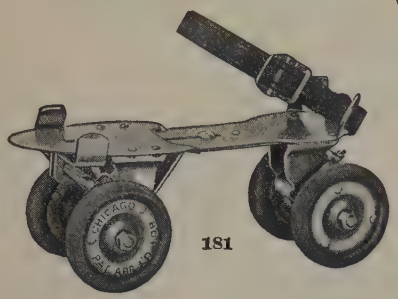

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Nature Study the Key to Knowledge

(Continued from page 49)

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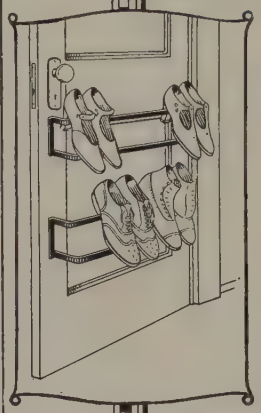

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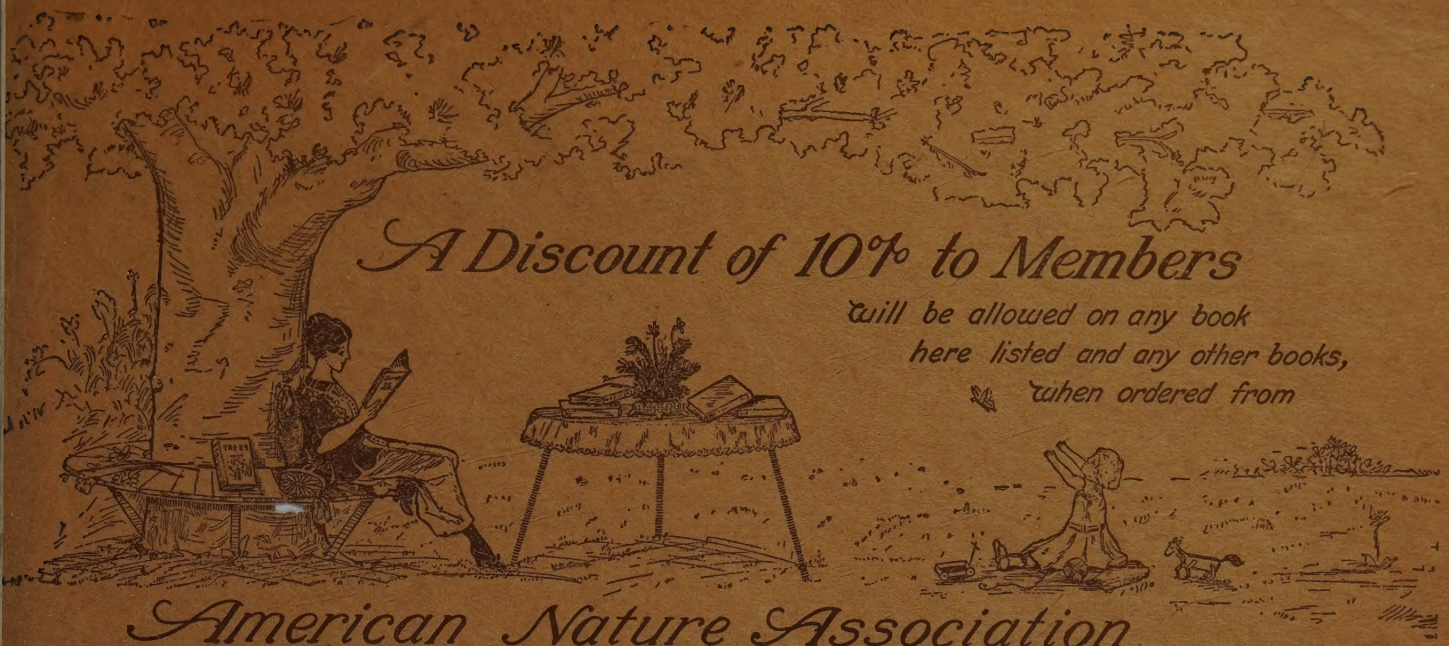

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